PAINTING AND DECORATING

Estimating

By J. RALPH DALZELL, B.S.

Head, Architectural Engineering Dept.

American School

and ALVAH HORTON SABIN, M.S.

Consultant on Paints and Varnishes

Illustrated

1947

American Technical Society

Publishers

CHICAGO, U. S. A.

Reprinted 1940
Reprinted 1943
Reprinted 1945
Reprinted 1946

Printed in the U.S.A.

Preface

THE purpose of this book is to teach the principles and application of the commonly used paints, varnishes, etc., which are used to preserve and beautify residences, barns, and other structures, and to present a system whereby painters can learn typical methods of estimating material and labor costs.

First, there is a general discussion of paints, varnishes, and other finishing materials in which the chemical composition of materials is briefly described and the formulation and mixing of paints explained. The reader will observe that the entire presentation is viewed from the standpoint of the painter.

Typical formulas, specifications, and other considerations, necessary in the ordinary painting and decorating job, are given and explained.

A chapter is devoted to exterior painting, one to interior painting, and another to stains, filling, etc. In all cases the aim of the authors has been to point out and explain all items which must be considered in painting and decorating ordinary structures. Good painting can be accomplished easily if the painter knows the many proper ways to prepare surfaces and to apply the paint, etc. This text does not attempt to treat painting problems beyond those commonly encountered, such as residences, barns, garages, and other small buildings.

Chapter IX on "Estimating" is of great importance to the painter, who aspires to become a contractor, and also to paint dealers and house owners. In this chapter the procedures explained are purely *typical* and should not be thought of as constituting any recommendation or standard procedures. The general principles of estimating, however, are true to form and if the reader masters them he will have gone a long way toward making accurate estimates.

The material and labor principles given cannot be assumed as absolutely set or standard. All these figures represent typical esti-

mating *only* in principle, because all such items vary considerably in different localities. However, the coverage figures and labor estimates should prove of value, because they represent cost analysis data extending over eighteen years of one contractor's experience. In the last analysis all the estimating data given in this book aim only to teach the *general* estimating principle and to show the reader what figures he must accumulate and how to use them in making an estimate.

Much of the material in this volume is included in the Building, Estimating and Contracting Cyclopedia.

RESIDENCE SHOWING WALLS IN OLD VIRGINIA WHITE PAINT AND ROOF IN GREEN STAIN

Courtesy of Samuel Cabot, Inc., Boston, Mass.

Acknowledgments

GRATEFUL acknowledgment is here made for the invaluable cooperation of some of the foremost paint manufacturers, listed below, in making this book thoroughly representative of the latest and best paint and formulation principles, application methods, and general instructions for painters; also to the contractors, listed below, for their special cooperation relative to estimating.

Aluminum Company of America, Pittsburgh

Sherwin-Williams Company, Chicago

Pratt and Lambert Company, Chicago

Sears-Roebuck & Company, Chicago

U. S. Gypsum Company, Chicago

National Lead Company, New York

Swan E. Foreman, Painting Contractor, Chicago

Herman Marks, General Contractor, Chicago

Contents

BRILLIANT WHITE OR SOFT PASTEL TINTS OF COLOR ADD TO THE BEAUTY OF STUCCO, CONCRETE, AND OTHER TYPES OF MASONRY STRUCTURES

Courtesy of United States Gypsum Company, Chicago, Illinois

PAINTING AND DECORATING

CHAPTER I

INTRODUCTION

Paint. In general terms paint is a name for the many fluid materials or thin coatings applied to various surfaces for protective and decorative purposes. These materials may be classed as *actual paint* and *varnishes,* the difference being that actual paint contains pigments and vehicles whereas varnish contains no pigments.

In technical terms paint is a mixture of opaque or semi-opaque substances or pigments with suitable liquids or vehicles which can be applied to surfaces by means of brushes or spray painting machines.

THE VALUE OR USEFULNESS OF PAINT

There are numerous uses for paint. In this book not all usages can be enumerated and described, therefore, only the main or common usages are given.

Preservation. All woods and most metals in common use will decay or rust rapidly unless some measure is taken to protect them from moisture, air, gases, etc. The decay in wood is especially rapid if it is not protected properly against various organisms. The decay in a piece of new wood, exposed to unfavorable conditions, can be detected within a course of two or three days by means of a microscope, whereas the naked eye is not able to detect it much before two or three weeks. Warping and twisting also start soon unless proper protection is given. Rusting takes place in metals immediately after an exposure to moisture or certain gases.

Paint therefore is used to seal the pores in wood so that no moisture or other destructive agent can enter. Paint also provides a sealing or surface coating for metals which water and gases cannot penetrate.

In past years many home owners and farmers neglected to protect their homes, barns, machinery, etc., properly, with the results that decay, rust, and general deterioration destroyed the structures and machinery long before their time and caused a great deal of un-

necessary expense and inconvenience. The importance of protecting surfaces by means of paint cannot be overemphasized. A few quarts or gallons of paint applied to surfaces at required intervals will prove economical in the long run.

There was a time when many people thought that wood and metals were practically everlasting and did not require any "expensive" painting. Today, however, the majority of people are realizing more and more the ill effects of water, wind, sunlight, gases, etc., upon unprotected wood and metal surfaces. The rotting or decaying of woods can be prevented if their surfaces are protected properly or sealed with paint. An old log in a woods decays rapidly, but properly protected wood in a house or barn retains its body and strength long after the log has rotted away.

The old saying that "saving the surface saves all" is worth considering.

Many of our modern building materials have the advantage of light weight, strength, and attractiveness. However, most of these materials require painting for protection against the elements.

Appearance. It is a fact that most people paint their homes, garages, and barns more for the sake of appearance than for any other reason. It is true that a well-painted house, garage, and barn speak well of the owner.

Many so-called "shabby" residences or "run down" barns could be made to look almost new by the proper application of colorful paint.

The interior of a home, so far as decorative painting is concerned, is of great importance because a well kept interior actually brings about a keener appreciation of living and makes the enjoyment of a home complete. Bright, well harmonized rooms add to our sense of well being and help us to see the brighter side of life whereas dull poor harmonized rooms have a tendency to cloud our minds. The difference is not unlike the reactions experienced on cloudy and sunlit days.

Economic Considerations. Aside from the economy of preservation, a well-painted structure increases its actual value. The difference between shabbiness and proper painting can be understood clearly by picturing two automobiles both of which are the same age but one shabby and dull and the other bright and shiny. The value

of the two cars in the minds of most people is in favor of the shiny car. It follows therefore that residences or barns are worth more in sales and desirability if they are painted well and have a good appearance.

Sanitation. Paint resists moisture, vermin, germs, and odors, which is of great importance to health and comfort. A wood or metal surface cannot be kept clean unless it is painted. The pores, if unprotected, catch dust, dirt, greases, etc., and it is impossible to remove such undesirables after a short exposure unless the surface is painted. In kitchens, milk houses, etc., where cleanliness is of special importance, painted walls and floors can be kept spotlessly clean by the use of soap and water. Special paints can be purchased which stand daily washing.

Insulation. Without delving into any scientific discussion it can be stated that a bright surface reflects most of the heat or cold. We all know that white or bright colored materials are used for tropical country dress. The principle is that light colors reflect the sun's rays and dark colors absorb them. Thus a light colored dress or suit is cooler than a dark colored one. The same principle holds true for retarding heat and cold in buildings. A bright exterior surface reflects much of the heat from the sun and keeps the interiors of buildings cooler. In like manner a bright interior surface tends to reflect heat in summer and lessen the heat loss during the winter. Painting accomplishes these desirable points easily and, from actual experiments during the last few years, it has been definitely determined that by proper painting we can add to our comfort in both summer and winter.

Fireproofing. A recent discovery has allowed the manufacture of a paint that fireproofs all wood. This paint performs protection of a kind that tends to do away with one of our greatest enemies and adds much to peace of mind and comfort. Farmers could consider well such a fireproofing benefit.

Interior Lighting. The natural and artificial lighting of residence and even barn interiors can be improved by painting. Not many rooms or other inclosures can have windows enough to provide ample or proper natural light and too strong or concentrated artificial light is not advisable. Light colors applied to interior walls and ceilings diffuse the natural and artificial light in all directions and thus make interiors brighter and easier on the eyes.

Many people, not understanding this principle have selected too much dark color, or, in the case of barns, have neglected to provide any interior paint, with the results that improper lighting is experienced. A little thought given to this matter makes a world of difference to interiors and helps to keep them cheerful, easy on the eyes, clean, and desirable.

KINDS OF PAINT

The various kinds of paint number into the hundreds and would require a large volume to describe them all. However, the commonly used varieties are described here for the readers general information. In presenting such a discussion, this volume does not infer that one paint is better than another. The discussion is purely from the standpoint of describing *typical* kinds of paint.

***Oil Paint.** When we think of an oil paint we must think in terms of a paint in which the vehicle is a drying oil of some kind, such as linseed oil. This oil is used to a great extent because it naturally absorbs oxygen and in so doing changes from a liquid to a solid. Most oil paints use either raw or boiled linseed oil. This mixture makes a desirable paint for interior use.

Driers and thinners are used to modify the oil. Turpentine makes the best thinner because it tends to dissolve the materials in the paint, and it also dissolves the resin in wood in cases where it is applied to wood. The dissolving of resins in wood surfaces brings about a greater penetration and adds to the paints adhesive ability.

Driers, such as litharge, manganese dioxide, liquid japans, and lead and manganese compounds are used in paint to quicken the hardening. They do this by tending to hurry the joining of oxygen from the air with the linseed oil.

Pigments used in oil paints generally are lead and zinc. They form the bulk of the paint and supply the coating properties.

In another chapter several typical formulas are given which show the formulation of lead and oil paints. It should be pointed out here that paints can be purchased either *ready to use* or *mixed on the job,* as preferred.

Graphite Paint. Graphite paint is made by mixing linseed oil

*See typical formulas in Chapter II.

with blake graphite. The graphite causes a slow drying of the oil and the small amount of silica, usually with the graphite, gives final hardness to the paint.

Water Paint. The difference between oil and water paint is that in water paint the vehicle is water. Such common items as calcimine, whitewash, etc., are typical water paints.

Most calcimine consists of powdered white chalk, pigment, and glue or casein used as a binder. The pigment in this case is in the form of a powder instead of an oil, as used with oil paints. Whitewash is made simply by shaking quicklime in water.

There are various other water paints all used as interior finish. They are suitable especially for spraying the interiors of barns.

Water-Thinned Paints. Water-thinned paints have vehicles of a protein base, derived from compounds found in certain plants and in milk. They are produced first in a dry powder form. In this state they readily combine with water. When the water evaporates a chemical change takes place, so that the vehicles form a tough transparent film thereafter insoluble in water. The pigments used in water-thinned paints are the same as used for oil paints and water is used as a thinner in place of oil or turpentine. These paints dry quickly and in themselves are fireproof.

Varnish. Varnish is a mixture of resin in alcohol or drying oil. It contains no pigment and after application hardens to a smooth and shiny surface by the evaporation of the vehicle. Some varnishes, such as oil varnishes, are mixtures of resin and boiled linseed oil.

Varnishes are manufactured with special uses in mind. For example, there are floor varnishes, rubbing varnish, spar (exterior) varnish, interior varnish, and flat (no gloss) varnish.

Shellac Varnish. Shellac varnish is made by dissolving either white or orange shellac in grain or wood alcohol. This shellac varnish produces a pleasing finish that has a dull luster.

Shellac. Shellac is made by refining seed lac. Its natural color is orange although sometimes it is made white by bleaching. The material lac is a resin, in nature, exuded by certain kinds of insects on twigs of trees.

Lacquer. Lacquer is a composition of nitrocellulose, resins, solvents, and softeners. All three materials add to the quality of the lacquer in that nitrocellulose makes it tough; hardness and luster

are brought about by the resin; and elasticity is given by the softeners. Alcohol is used as a solvent. Caster oil can be used as a softener. The nitrocellulose is made by treating cotton of short fibers with nitric acid.

Japan. Japans may be classed in two distinct classes. First, there is what is called painter's japan—a varnish which consists of solutions of metallic salts and resins in a drying oil. Second, there are decorative japans which are opaque varnishes containing asphaltum and which are designed to produce a high luster on the surfaces of woods and metals.

Enamel. This can be called an actual paint, since it contains pigment and a vehicle. Enamels can be called pigment varnishes. The base pigments are white, different colors being added to give the desired tint. The vehicle is varnish. This combination of pigment and varnish produces a surface that has ample luster. Some enamels are made of lacquers mixed with colored pigments.

Aluminum Paint. Aluminum paint consists of a finely divided pigment mixed with a vehicle. The aluminum pigment particles which are in the form of minute flakes are arranged in the paint film in more or less parallel layers. Vehicles for aluminum paint, as explained in Chapter VII, generally are a drying oil-resin base, nitrocellulose, and pitch or asphalt.

Stains. Stains are obtainable in four different kinds, namely, oil, water, spirit, and chemical stains.

Oil stains have an oil vehicle to which can be added turpentine which is a solvent and helps to increase the penetration. The coloring may be done by using pigments or aniline dyes.

Chemical stains, as their name implies, do their staining by means of chemical changes produced by the action of such chemicals as iron salts, potassium, zinc sulphate, etc., dissolved in water. Thus no coloring matter is required. The chemicals act on the woods and change them to various colors depending on the chemical and its action with the taxin in the wood.

Water stains are solutions of aniline dyes and water.

Spirit stains contain alcohol, for example, in place of water.

Miscellaneous Paints. There are many more kinds of paint insofar as trade names are concerned. Most of the various trade named paints fall into one or more classes of paints already considered.

PURCHASING PAINT

Paint may be purchased in one of two general ways which are explained as follows:

Ready-to-Use Paint. Ready-to-use paint can be purchased in cans all ready for use. It only needs a possible stirring or thinning or coloring added to it. All kinds of paint, varnish, stains, lacquer, enamel, etc., can be obtained ready to use through the various paint stores, mail order houses, etc. The painter can secure any type of paint for any purpose in first-class grades and in any colors required. Such paints may be used with confidence and the only care should be to purchase the best of paints, as it is poor economy to buy cheap paint. The manufacturers generally place necessary directions on the cans.

Mixed-on-the-Job Paint. Mixed-on-the-job paint means that all materials to mix the paint are purchased separately and then mixed just prior to using them. In other words, if the painter was purchasing paint in this manner for ordinary exterior woodwork he also would purchase, for example, white lead, linseed oil, turpentine, and a drier and then mix them himself according to a formula. Paints made in this manner are first class the same as ready-to-use paints.

The formulas in the text for mixed-on-the-job paints are shown and explained because by using the formulas the formulation of paints in general can be explained for the reader. The exact formulation of all-ready-to-use paints cannot be described within the bounds of any one volume. However, if typical formulas are shown, the reader will have an idea of how paints are mixed, and if he understands these formulas he will understand paint in general, as all oil paints somewhat are alike.

It is pointed out here that this text infers no recommendations one way or the other, as both ready-to-use and mixed-on-the-job paints are first class.

PAINT MATERIALS

All oil paints are made with practically the same general materials. Such materials are described in the following with the exception of aluminum paint materials explained in Chapter VII.

White Lead. Basic carbonate of lead is a compound of lead, carbonic acid and water. The lead is melted and cast into disk-

like perforated round forms each of which may be about 6 inches in diameter.

These castings then are placed in porcelain pots which also contain vinegar. The vinegar does not contact the lead but is kept in a separate recess in the pot. Several pots are charged at the same time and placed in sealed rooms or areas which can be practically sealed. Tanbark is placed between the tiers of pots so that it is not far from any pot. After the room is closed for about four months the heat, and carbonic acid gas generated by the fermentation of the tanbark, along with the acid vapors, transforms the lead into white flakes. These flakes are crushed and ground in water. After the ground compound has dried, it forms the white lead used in paint.

Another method called "Quick Process White Lead," is made by melting lead and blowing it into very fine granules by means of air. The lead becomes powdery and is then put into a wooden, slowly revolving cylinder which has been moistened with acetic acid and left to the action of air and purified carbonic acid gas.

The white lead resulting from the foregoing processes is without form and is opaque. These qualities, together with the fact that it does not require much linseed oil to make it suitable for brushing, tend to make white lead a good protective covering for woods and metals. White lead can be purchased in cans or drums ready to be mixed with the other parts of common paints as shown in "Mixed-on-the-Job Specifications."

Litharge. Lead is easily melted. If the melted metal stands for a minute or two in the air, it becomes covered on the surface with a dull coating which may be skimmed off. This coating is the result of the union of lead with oxygen. When the molten lead is in a furnace and fresh air is admitted, all the metal may be oxidized by stirring it so that it is brought in contact with air. The mixture obtained is called litharge. It is sold in powdered form ranging in color from yellow to reddish brown.

Red Lead. Lead melts at 620° F. but litharge is made rapidly at 1100° F. to 1200° F. If we let the heat go down to about 900° F. and still agitate the litharge in air, it takes up more oxygen and forms an entirely different chemical compound. This is bright red and is called red lead.

When making paint using red lead, it should be mixed somewhat as follows: Allow the pigment to take up oil to its full capacity for a period of 24 hours, then stir it to the consistency of a thick paste. This can be thinned by the addition of oil.

Linseed Oil. Linseed oil is made from flaxseed by pressing the seed. This oil is used as a drying oil. When in a paint film, it combines with the oxygen from the air and becomes a tough, firm, elastic solid. If pigment to the extent of ⅓ to ½ of the oil's volume is mixed with the oil, the film is much harder and continues to grow hard for as long as a year.

Oil takes on weight as it oxidizes though it subsequently loses part of this by long continued oxidation. Moreover, it contracts to a considerable degree on complete drying with the result that it is much denser. This shrinkage causes a tendency for the paint film to pull. Sometimes it will loosen the underlying film, whether dirt, loose scale or old paint, especially if the latter has begun to decay.

Blown linseed oil is oil that has been heated and has had air blown through it to oxidize and thicken it. Some oil, having a little of this treatment but not enough to thicken it appreciably, is sold under the rather misleading name **aged oil.** There has always been a belief that oil improves if it is aged for several months in a tank in a warm room. However, what is known commercially as aged oil is not old but simply has been blown a little. Blown oil is not used in red lead paints.

Heat-treated oil, also known as **lithographic oil** has been heated for several hours without blowing at a temperature of 550° F. to 650° F. It then becomes thick, like honey, and must be thinned with turpentine or mineral spirits to make it brush out. It is largely in oil-enamel paints.

Tung Oil. Tung oil comes from the nut of a tree grown in China. It is a drying oil, being more strongly drying than linseed. In the raw state, however, it skins over in drying in a way that prevents its use in paint.

If properly heat-treated in mixtures with linseed oil, common rosin or litharge, tung oil dries with a smooth surface. Though more water-resistant than linseed oil, it is considerably less durable. The only large use of tung oil in paint is as an ingredient of an oleoresinous varnish, generally a rosin varnish, to add gloss to paint.

Tung oil costs more than linseed oil. On the other hand, it is like any heat-treated oil in that it will bear dilution with cheap mineral benzine until a liquid lower in cost than linseed oil is obtained. The appealing feature about such a vehicle is that it dries quickly, but it cannot be recommended for permanence. For shop painting first-coat work, when speed is a factor, tung oil vehicles prove attractive and the engineer and his inspector should be on guard against them.

Turpentine. There are many varieties of turpentine. It is a colorless, volatile liquid which mixes with oil or paint. Turpentine thins paint about twice as much as an equal volume of oil. At the same time, it has a strong solvent power. Added in the proper quantity to a paint which is to be applied over an old, dry coating, it penetrates the surface and enables the new paint to stick better. It also penetrates new wood, dissolving some of the pitchy and other paint-resisting portions of the lumber. Here turpentine is essential. It is also useful in paint when it is desired to have the pigment in larger proportion to the oil so it will work well under the brush. If a harder finishing coat than ordinarily is used is wanted to minimize dirt discoloration or to prevent the possible growth of mildew, the customary amount of linseed oil for a finishing coat is reduced and enough turpentine added to give a brushable paint. For brushing purposes, the turpentine takes the place of the linseed oil left out. After the paint is applied, the turpentine evaporates. It has served simply to enable the heavy paint to be brushed on easily. In other words, it is a volatile thinner.

Benzine acts like turpentine as a volatile thinner and is cheaper in price but it does not possess as much solvent power. Consequently, benzine is not recommended to soften old paint or to penetrate into wood.

Driers. Because raw linseed oil does not dry fast enough for paint, its drying is hastened by the addition of a drier which aids the oil to take up oxygen more rapidly.

A paint drier is a liquid of such composition that when 5 to 10% of it by volume is added to raw oil it will cause the film of paint to dry to the touch in from 8 to 12 hours according to the weather.

A paint drier is a mixture of oil-soluble compounds of lead and manganese and sometimes a small amount of cobalt is added. The

compounds are made by heating the oil with the oxides of these metals. From 70 to 80% of the liquid in a drier is either turpentine or benzine.

There are driers also which contain rosin instead of oil. That these are inferior is a general agreement. Although, if the rosin is restricted to the amount necessary to combine with the metallic ingredients, it is not certain that bad results will follow. However, there appears to be an irresistible temptation to use rosin to excess in driers. Most writers, however, specify rosin-free drier.

Boiled oil does not require the addition of a drier because it contains lead and manganese. The same is true of varnish.

A good rule to follow is not to add too much drier to paint. It may affect the proper drying of the paint by causing too rapid top-drying.

Lead Mixing Oil. Lead mixing oil is designed especially for use with white lead. It produces a paint that seals, protects, and beautifies all porous surfaces whether they be plaster, concrete, brick or stucco—interior or exterior.

Interior paint made with white lead and lead mixing oil may be used for all coats on new plaster or wallboard. In the priming coat, it seals the surface, and in the final coat, it produces a flat finish. Its solid, smooth surface is not only beautiful but also sanitary and enduring. The hard tough film withstands frequent washing. Lead mixing oil with white lead also makes a good undercoating for enamels.

Exterior paint made with white lead and lead mixing oil is good for concrete.

Flatting Oil. Flatting oil is a special vehicle used on interior work. Mixed with white lead, it produces a paint which dries to a flat finish. Also, paint made with it levels out slowly enough so that a sharp stipple finish can be produced.

Flatting oil is an excellent medium for glazing and for the preparation of white lead and oil paint. It also can be used in staining wood and in producing grained effects.

Colors in Oil. When white lead is mixed with oil, according to such typical formulas as shown in Chapter II, white paint is the result. However, it is a simple matter to tint such paint to any desired shade by adding what are known as colors in oil. These colors can

be purchased in tubes or cans. They are concentrated color pigments, some of which are natural earths and others chemical compounds. Both types are mixed with oil to a paste that easily can be incorporated into paint. They may be used straight if properly thinned.

Zinc Oxide. Zinc oxide is a combination of zinc and oxygen. In the American process, ores of zinc mixed with powdered anthracite are reduced and volatilized in a closed furnace, having perforated grate bars, and the resultant zinc oxide, after being blown through a series of cooling flues, is collected in cloth bags.

In size it is one of the finest of all white pigments and in color one of the whitest. It requires more oil than most other white pigments. In 100 pounds of zinc oxide paint ready for use, there are about 46 pounds of oil and 54 pounds of pigment. Zinc oxide is unaffected in color by any gases present in the atmosphere, has no visible effect upon any pigment with which it may be mixed, and is non-poisonous.

Drying Oils. Oils used for this purpose in paints are either vegetable or animal. By the process of absorbing oxygen a hardening process takes place when these oils are mixed with paints and the paints have been applied. The paint hardens into an elastic film. Oils for this purpose are linseed, tung, fish oils, etc.

Thinners. Thinners are liquids which form clear solutions with the oils used in paint and upon exposure evaporate rapidly. Such an agent as turpentine is used extensively as a thinner.

GENERAL HELPFUL SUGGESTIONS

In the following a few helpful suggestions are listed which have been found by experience to be worth while remembering.

Apply paint in thin rather than thick coats.

Be sure to cover all knots or sappy places with shellac before painting.

Shellac brushes can be cleaned only in alcohol.

Varnish brushes can be cleaned with turpentine.

Keep brushes in a place where no excessive heat may cause them to shrink.

Never use a paint brush for dusting.

Cover all paint cans at night.

Do not leave brushes standing in paint or varnish.

Stir paint at frequent intervals.

For exterior painting follow the shade in summer and the sun in the fall.

Break in new brushes on priming coats.

Lime is not good for a bristle brush.

Putty should be used *after* priming.

Hot vinegar will remove paint and varnish from window glass. Safety razor blades also may be used.

Gasoline, turpentine, or benzine may be used to remove paint from the hands, clothing, rugs, etc.

GLOSSARY OF TERMS

Vehicle. The liquid part of paints, such as linseed oil, is called the vehicle.

Pigment. The solid (finely divided) part of paint, such as lead, is called pigment.

Boxing. Mixing paint by pouring from one bucket to another several times is called boxing.

Raw Oil. Linseed oil in its natural state is called raw oil.

Boiled Oil. Raw oil which has been heated to 450° F. or 500° F. and to which has been added a small amount of oxide of lead or oxide of manganese, or a mixture of the two, is called boiled oil.

Paint Mixer. A power device for mixing pigment and oil.

Paint Mill. A grinder of steel or mill-stones for grinding and mixing mixtures of pigment and oil.

Volatile Thinner. Such a thinner is sometimes mixed with mixtures of oil and pigment. Turpentine and benzine are examples.

Drier. A drier is a compound of lead or manganese (generally both), soluble in oil, and is usually sold, under the name of *paint dryer* or *paint japan*. It is usually of such strength that by adding from 5 to 10% of it to a raw-oil paint will make it dry in from 6 to 12 hours.

White Lead. See explanation in previous pages. White lead is the most important white pigment.

White Zinc. This is a somewhat purer white than white lead but not so opaque. More coats of white zinc are required for good coverage than white lead.

Coverage. A term employed to indicate the amount or area a given amount of paint will cover and also how well it conceals the original surface being painted.

Colors in Oil. Colors used to tint or color mixtures of white lead and oil.

Fillers. Fillers are of two kinds—paste and liquid. Paste fillers are something like a very thick paint, and are composed of some solid powdered substance, usually silica or powdered quartz, mixed with a quick-drying varnish thinned with turpentine or benzine. This is applied to the dry surface of the wood with a stiff, short-bristle brush, or is put on with a clean white cotton cloth, and rubbed well into the pores of the wood. After half an hour or so, the surface of the wood is wiped off either with a wad of excelsior, a clean cloth or a piece of felt. A liquid filler is a quick-drying varnish; and most of the liquid fillers on the market are cheap rosin varnishes loaded with driers and should never be used. Paste fillers are the best in almost all cases.

Priming Coat. A coat of paint applied to surfaces which serves as a foundation for second and third coats. It seals the pores and anchors the paint to the surface.

Varnish. Varnish is a liquid applied to a surface in a thin film. See also explanation in previous part of this chapter.

Shellac. Shellac is a resin which comes in large thin flakes. It is dissolved in alcohol for use. Common shellac is a brownish yellow and is called *orange shellac*. *White shellac* is made by bleaching with chlorine.

Damar. Damar is a white resin which is soluble in spirits of turpentine—five or six pounds of resin to a gallon of turpentine. It is a nearly colorless varnish which never becomes very hard. It is used to a considerable extent as a vehicle for white lead and zinc to make a white enamel paint. It is not durable if exposed to the weather.

Stippling. A finish made by applying a wire brush to applied paint before it is dry. This is done by tapping the surface with the brush in short rapid taps.

Flat Paint. A paint that dries leaving the surface shineless.

Gloss Paint. A paint that dries leaving the surface shiny.

Chalking. A tendency of improperly mixed or applied paint to become chalk-like and rub or drop off the surface.

Solvents. Volatile liquids, usually of low boiling points, used to dissolve the natural and non-reactive synthetic resins entering into the composition of varnish. Some of them are used to dissolve the nitrocellulose used in making lacquer.

Paste Wood Fillers. Compound supplied in the form of a rather stiff paste for filling the "grain" of hard woods, so as to produce a level surface for varnishing. The paste wood fillers consist usually of finely powdered mineral substances ground in a special type of varnish. They are applied by brushing, and the surplus is wiped from the surface of the wood after setting and before hardening.

Liquid Wood Fillers. Varnishes of low viscosity, usually containing very finely divided solid matter, for use as a first coating on porous woods characterized by fine grain, such as poplar, white pine, etc. Their purpose is to afford a non-absorbent surface for the succeeding coats of varnish. They are frequently colored, so as to stain and fill in one operation.

Linoleum Varnish. Special highly flexible and elastic varnishes used in both clear and pigmented forms as the finishing coats on linoleum. Good floor varnish makes an excellent material for renewing these.

Machinery Varnish. Varnishes designed to give machinery surfaces a gloss and a protection from moisture, etc.

Blistering. Blisters form on a painted or varnished surface due to underlying spots of grease or moisture or to excessive heat.

Bloom. Opalescence of the surface caused by excessive moisture before drying.

Livering. Coagulation of paint or varnish into a viscous mass.

Creosote Oil. A product made from coal tar and used as a wood preservative.

RESIDENCE AT SACRAMENTO, CALIFORNIA, SHOWING BRICK WALLS FINISHED IN DOUBLE WHITE PAINT

Courtesy of Samuel Cabot, Inc., Boston, Mass.

CHAPTER II

SPECIFICATIONS

Specifications are important items in any painting and finishing work, especially if the work is being done under contract. In many ways they protect the owner, or person paying for the work, as well as the contractor.

Specifications assure the owner of exactly what he wants in terms of what is to be done and the quality of material. Specifications help the contractor to make his bid and resulting contract more nearly correct and assure him that no extras will be required.

Misunderstandings are bound to occur unless there is a distinct understanding between the owner and the contractor. Good specifications eliminate all these misunderstandings and make for better workmanship according to schedule, and make for better conditions generally.

In this text, as explained in Chapter I, both mixed-on-the-job and ready-to-use paints are considered. The specifications for each type naturally differ somewhat in their presentation. In the following, two typical sets of specifications are shown. Much can be learned from them as regards paint and its practical application.

*MIXED-ON-THE-JOB PAINT SPECIFICATIONS

The specifications for painting and finishing, using mixed-on-the-job paint, are divided into two parts: Sections A and B.

Section A contains those clauses which specify the materials to be used and outlines the general manner in which the work shall be carried forward.

Section B contains the directions for surface preparation and application of the paint on the particular surfaces to be painted.

In preparing specifications for the painting contractor, it will be necessary to include only those paragraphs that cover the exact work to be done. For the user's convenience we have employed letters and numerals to designate the sections, their main divisions and the paragraphs of the latter.

If desired, detail of work to be done as outlined in Section B is the only part which need be written out in full. The details of materials and workmanship may then be covered by the following clause:

All painting work under this contract, except as hereinafter specified, shall be executed in strict conformity with the Painting Specifications Covering the

*Courtesy of National Lead Co.

Use of (_____) Products, issued by the manufacturer which Specifications are hereby declared and made part of this specification, with the same force and effect as if written herein in full.

SECTION A

Part I—General Requirements

1. **General Conditions.** The general conditions of the American Institute of Architects shall form a part of these specifications, and all work shall be subject to the provisions thereof, insofar as they apply to work under these specifications.

2. **Work Included.** (a) The painting contractor shall supply all labor, materials, tools, staging, and equipment necessary and shall perform all painting and finishing work in connection with the building described as follows:

(b) (Here describe generally the work which is to be painted.)

(c) (Here also describe work which is to be primed under other specifications but finished under these specifications.)

3. **Drawings.** (a) The painting contractor shall be furnished with all drawings, details and other information necessary for the painting of all classes of work which are to receive a painted finish.

(b) In the event of any doubt or question, respecting the drawings and/or specifications, references shall be made to the architect whose decision thereon shall be final.

4. **Samples.** (a) Samples of all finishes shall be submitted to the architect for approval before applying, and finished work shall match same.

(b) The painting contractor shall carefully inspect each surface before applying any finish and if same is not in proper condition, he shall notify the architect in writing. Otherwise the contractor will be held responsible for any defects in the finish arising therefrom.

5. **Inspection.** (a) The architect, or his duly authorized representative shall have access at all times to the stock of materials and shall be furnished with every reasonable facility for ascertaining that the workmanship is in accordance with the requirements and intent of these specifications.

(b) Defective work shall be made good and unsuitable materials may be rejected. The architect reserves the right to replace both at the expense of the painting contractor.

6. **Alterations and Remodeling.** All present work that is removed and reset or that is affected in any way by the alterations and remodeling, shall be refinished to match the finished surfaces adjacent thereto.

7. **Storage.** The painting contractor shall store his materials in one place in the building, and such storage place shall be kept neat and clean and all damage thereto or to its surroundings shall be made good; care being taken in the storage of paints, oils, etc., to prevent all danger of fire. Oily rags shall be removed from the building every day upon the stopping of work.

8. **Cleaning.** Upon completion of the building, the painting contractor shall remove all paint spots from all finished work, and shall leave the entire premises free from rubbish caused by his work; and shall remove his equipment from the premises. He shall present the work clean and free from blemish.

(Washing glass is not intended to be included in this specification. If the

architect wishes it to be included, he should specifically mention this fact.)

9. **Extras.** The painting contractor shall not be entitled to payment in excess of the amount agreed upon in his contract for any extra work over and above that specified herein, unless authorized in writing by the architect or his superintendent.

10. **Protection of Work.** It shall be the painting contractor's responsibility to protect his work, and the work of all other contractors during the time his work is under way. He shall be responsible for any and all damage to the work or property of others caused by his employees or himself.

11. **Workmanship.** (a) Before any painting is done, all surfaces shall be clean, smooth and free from dust, dirt, grease, mortar, rust and other foreign substances and all parts where paint remover has been used shall be washed off with turpentine or benzine.

(b) All paint shall be evenly spread and thoroughly brushed out.

(c) No coat of paint shall be applied on a wet or damp surface and in no case until preceding coat is dry and hard.

(d) No painting shall be done on outside work in extremely cold, frosty, foggy or damp weather. Painting done in winter weather shall be done only when the temperature is above 50° F. and when all surfaces are dry.

Part II—Materials

12. **General.** All materials for painting shall be delivered at the building in unbroken packages, bearing the manufacturer's brand and name, and shall be used without adulteration.

Materials covered in these specifications are: white lead, colors in oil, linseed oil, lead mixing oil, flatting oil, wall primer, turpentine, drier, varnish, shellac varnish, putty and red lead.

13. **Mixing.** All paint shall be mixed at the job in a manner to assure the proper incorporation of the ingredients and in conformity with formulas as given hereinafter.

14. **Materials.** Here state and explain the quality, trade-name, etc., of all such materials to be used. A check list is as follows:

(a) white lead
(b) red lead
(c) colors in oil
(d) linseed oil
(e) lead mixing oil
(f) flatting oil
(g) wall primer
(h) turpentine
(i) drier
(j) varnish
(k) shellac
(l) putty
(m) lacquer
(n) Japan
(o) wax
(p) filler
(q) remover

SECTION B

Application

1. **Painting New Exterior Wood.** (a) (Here list and describe surfaces to be painted.)

(b) Door and window casings, mullions, etc., shall be sanded to remove

loose edges left by sanding machine. All surfaces shall be free from slivers, splinters, etc.

(c) After priming coat is dry, knots and sappy streaks shall receive one coat of shellac varnish brushed out thin and all cracks, nail holes, etc., shall be puttied with white-lead putty.

(d) All painting work shall be allowed to dry from four to six days before the next coat is applied.

(e) All surfaces shall be primed with Formula (1) and receive two additional coats, using Formulas (2) and (3), respectively.

(f) (If colors other than white are to be used, the necessary tinting materials should be added to the last two coats of paint. Specifications of colors and where they are to be used should be stated here.)

Formula (1)*

Priming Coat—New Exterior Wood

Materials	Soft Paste	Heavy Paste
†(_____) white lead	100 pounds	100 pounds
(_____) linseed oil	4 gallons	4 gallons
Pure turpentine	1¾ gallons	2 gallons
(_____) liquid drier	‡1 pint	‡1 pint

The above formula makes 9 gallons of paint which covers about 600 square feet per gallon, one coat.

Formula (2)

Second Coat—New Exterior Wood

Materials	Soft Paste	Heavy Paste
(_____) white lead	100 pounds	100 pounds
(_____) linseed oil	1½ gallons	1½ gallons
Pure turpentine	1¼ gallons	1½ gallons
(_____) liquid drier	‡1 pint	‡1 pint

The above formula makes 6 gallons of paint which covers about 700 square feet per gallon, one coat.

Formula (3)

Finish Coat—New Exterior Wood

Materials	Soft Paste	Heavy Paste
(_____) white lead	100 pounds	100 pounds
(_____) linseed oil	3 gallons	3 gallons
Pure turpentine		1 quart
(_____) liquid drier	‡1 pint	‡1 pint

§The above formula makes 6¼ gallons of paint which covers about 700 square feet per gallon, one coat.

*Formulas shown are typical. They are used here merely as examples and no recommendation is inferred.
†Insert name or trade name of manufacturer.
‡If boiled oil is used, reduce drier to ½ pint.
§See Chapter IX for Estimating.

2. **Repainting Exterior Wood.** (a) (Here list and describe surfaces to be painted.)

(b) (If any portions of old paint must be removed and surface re-primed, here list and describe such surfaces and their treatment.)

(c) After the first coat has dried sufficiently, nailholes, cracks, etc., shall be puttied with white-lead putty.

(d) All painting work shall be allowed to dry from four to six days before the next coat is applied.

(e) All surfaces shall receive two coats of paint, using Formulas (4) and (5), respectively.

(f) (If colors other than white are to be used, the necessary tinting materials should be added to both coats of paint. Specifications of colors and where they are to be used should be stated here.)

Formula (4)

First Coat—Repainting Exterior Wood

Materials	Soft Paste	Heavy Paste
(_____) white lead	100 pounds	100 pounds
(_____) linseed oil	2 gallons	2 gallons
Pure turpentine	1¾ gallons	2 gallons
(_____) liquid drier	*1 pint	*1 pint

The above formula makes 7 gallons of paint which covers about 700 square feet per gallon, one coat.

Formula (5)

Finish Coat—Repainting Exterior Wood

Materials	Soft Paste	Heavy Paste
(_____) white lead	100 pounds	100 pounds
(_____) linseed oil	3 gallons	3 gallons
Pure turpentine		1 quart
(_____) liquid drier	*1 pint	*1 pint

The above formula makes 6¼ gallons of paint which covers about 700 square feet per gallon, one coat.

3. **Painting Brick, Stucco, Stone or Concrete.** (a) (Here list and describe surfaces to be painted.)

(b) Unpainted stucco or concrete which has not been allowed to age for a period of six months or longer, shall be treated with a solution made by dissolving two pounds of zinc sulphate in one gallon of water. After the zinc sulphate solution has been applied, sufficient time shall be allowed for the stucco or concrete to dry before priming.

(c) Unpainted brick work shall be brushed vigorously with a wire brush to remove efflorescence or other foreign substances. If any mortar has become loose or damaged, all such places shall be pointed with mortar before paint is applied. After priming, small defects in the surface shall be corrected with putty.

(d) Previously painted stucco, concrete, brick or stone surfaces shall

*If boiled oil is used, reduce drier to ½ pint.

be dry-brushed before painting. If the old paint shows blistering, cracking or scaling, the surfaces shall be brushed vigorously with a wire brush before painting.

(e) Unpainted exterior brick, stucco, stone or concrete surfaces or all such surfaces which have been wire-brushed to remove completely the old paint, shall be primed with Formula (6) and shall receive two additional coats, using Formula (7) for the second coat and Formula (8) flat finish; (9) semi-gloss finish; or (10) gloss finish for the finishing coat. (Previously painted surfaces on which the old paint is in good condition do not require the priming coat.)

(f) (If brick is to be lined, it should be so specified here.)

(g) (Interior brick, stucco, stone or concrete surfaces should be painted the same as interior plaster.)

(h) (If colors other than white are to be used, the necessary tinting materials should be added to the last two coats of paint. Specifications of colors and where they are to be used should be stated here.)

Formula (6)

Priming Coat—Brick, Stucco, Stone or Concrete

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	*4 to 5 gals.	*4 to 5 gals.

The above formula makes from 7 to 8 gallons of paint which covers about 200 square feet per gallon, one coat.

Formula (7)

Second Coat—Brick, Stucco, Stone or Concrete

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	*3 to 4 gals.	*3 to 4 gals.

The above formula makes 6 to 7 gallons of paint which covers about 400 square feet per gallon, one coat.

Formula (8)

Third Coat—Brick, Stucco, Stone or Concrete (Flat Finish)

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	*3 to 4 gals.	*3 to 4 gals.

The above formula makes 6 to 7 gallons of paint which covers about 600 square feet per gallon, one coat.

*The minimum amount of lead mixing oil should be used when the greatest amount of hiding is desired.

Formula (9)

Third Coat—Brick, Stucco, Stone or Concrete
(Semi-Gloss Finish)

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	*2 to 3 gals.	*2 to 3 gals.

The above formula makes 6 to 7 gallons of paint which covers about 600 square feet per gallon, one coat.

Formula (10)

Third Coat—Brick, Stucco, Stone or Concrete
(Gloss Finish)

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) linseed oil.....	3 gallons	3 gallons
Pure turpentine		1 quart
(_____) liquid drier.....	†1 pint	†1 pint

The above formula makes 6¼ gallons of paint which covers about 600 square feet per gallon, one coat.

4. **Painting Interior Wood.** (a) (Here list and describe surfaces to be painted.)

(b) New woodwork shall be sandpapered smooth where required and dusted clean before priming.

(c) Old painted or varnished woodwork that shows bad cracking, checking or scaling shall be stripped by means of a good paint and varnish remover, and then cleaned with benzine or turpentine. Woodwork that is greasy or coated with wax should be scrubbed clean with turpentine or benzine before painting.

(d) All nail holes, cracks, dents or other defects shall be filled with white lead putty after the priming coat has dried.

(e) All unpainted wood, or surfaces from which the paint has been removed completely, shall be primed with Formula (11) and shall receive two additional coats, using Formula (12) for the second coat and Formula (13) flat finish; or (14) semi-gloss finish for the finishing coat. (Previously painted surfaces on which the old paint is in good condition do not require the priming coat.)

(f) (If a gloss finish is wanted on interior wood, specify a prepared enamel for the third or finishing coat.)

(g) (If colors other than white are to be used, the necessary tinting materials should be added to the last two coats of paint. Specifications of colors and where they are to be used should be stated here.)

---

*The minimum amount of lead mixing oil should be used when the greatest amount of hiding is desired.

†If boiled oil is used, reduce the drier to ½ pint.

Formula (11)

Priming Coat—Interior Wood

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) linseed oil.....	3 gallons	3 gallons
Pure turpentine	1¾ gallons	2 gallons
(_____) liquid drier.....	1 pint	1 pint

The above formula makes 8 gallons of paint which covers about 700 square feet per gallon, one coat.

Formula (12)

Second Coat—Interior Wood

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	3 gallons	3 gallons

The above formula makes 6 gallons of paint which covers about 800 square feet per gallon, one coat.

Formula (13)

Third Coat—Interior Wood (Flat Finish)

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	3 gallons	3 gallons

The above formula makes 6 gallons of paint which covers about 800 square feet per gallon, one coat.

Formula (14)

Third Coat—Interior Wood (Semi-Gloss Finish)

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	50 pounds	50 pounds
(_____) lead mixing oil.....	1½ gallons	1½ gallons
(_____) wall primer.....	3 gallons	3 gallons

The above formula makes 6 gallons of paint which covers about 800 square feet per gallon, one coat.

5. Painting Interior Plaster. (a) (Here list and describe surfaces to be painted.)

(b) Before any paint is applied, plaster surfaces, either new or old, shall be made clean and smooth.

(c) All cracks and holes shall be filled with plaster of Paris or approved patching plaster. Large cracks before filling shall be opened up in dovetail shape clear to the lath and soaked with water. The filling plaster shall be leveled off even with the adjoining plaster surfaces, and when dry shall be sandpapered smooth.

(d) Walls that have been calcimined shall be washed until all calcimine is removed before applying any paint.

(e) Where new plaster to be painted is not properly aged, the surfaces shall be treated with a solution made by dissolving two pounds of zinc sulphate in one gallon of water. After the zinc sulphate has been applied, sufficient time shall be allowed for the plaster to dry before priming.

(f) All plaster not previously painted shall be primed with Formula (15) and shall receive two additional coats, using Formula (16) for the second coat and Formula (17) flat finish; (17-1) special flat finish for stippling; or (18) semi-gloss finish for the finishing coat. (Plaster previously painted does not require the priming coat.)

(g) (If a gloss finish is wanted on interior plaster, specify a prepared enamel for the third or finishing coat.)

(h) (If colors other than white are to be used, the necessary tinting materials should be added to the last two coats of paint. Specifications of colors and where they are to be used as well as any instructions as to special decorative finishes should be stated here.)

Formula (15)

Priming Coat—Interior Plaster

***(_____) wall primer**

Wall primer covers about 800 square feet per gallon, one coat.

or

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	†4 to 5 gals.	†4 to 5 gals.

The above formula makes 7 to 8 gallons of paint which covers about 800 square feet per gallon, one coat.

Formula (16)

Second Coat—Interior Plaster

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	†3 to 4 gals.	†3 to 4 gals.

The above formula makes 6 to 7 gallons of paint which covers about 800 square feet per gallon, one coat.

Formula (17)

Third Coat—Interior Plaster
(Flat Finish)

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	†3 to 4 gals.	†3 to 4 gals.

The above formula makes 6 to 7 gallons of paint which covers about 800 square feet per gallon, one coat.

*(_____) wall primer should always be specified when walls are extremely porous or in an otherwise poor condition.

†The minimum amount of lead mixing oil should be used when the maximum amount of hiding is wanted.

Formula (17-1)

Third Coat—Interior Plaster
(Special Flat Finish for Stippling)

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	*2 gallons	2 gallons

The above formula makes 5 gallons of paint which covers about 600 square feet per gallon, one coat.

Formula (18)

Third Coat—Interior Plaster
(Semi-Gloss Finish)

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	50 pounds	50 pounds
(_____) lead mixing oil.....	1½ gallons	1½ gallons
(_____) wall primer.....	3 gallons	3 gallons

The above formula makes 6 gallons of paint which covers about 800 square feet per gallon, one coat.

6. **Painting Wood Floors.** (a) (Here list and describe surfaces to be painted.)

(b) All wood floors shall be cleaned and sandpapered smooth before painting. If the old paint on a previously painted floor is in bad condition, it should be removed by planing, scraping or by the use of a liquid paint remover.

(c) All work shall be allowed to dry for at least four days before the next coat is applied.

(d) All floors not previously painted, or from which the paint has been removed, shall be primed with Formula (19) and shall receive two additional coats, using Formulas (20) and (21) respectively.

(e) All floors previously painted shall be touched up on worn places using Formula (20), after which they shall receive two coats, using Formulas (20) and (21), respectively.

(f) (Specifications of colors should be stated here. The necessary tinting materials should be added to the last two coats.)

(g) Underside of all new porch floors and the tongued and grooved edges of the boards shall receive one coat, using Formula (22).

Formula (19)

Priming Coat—Wood Floors†

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) linseed oil.....	3 gallons	3 gallons

*For a stipple with a somewhat sharper texture, (_____) flatting oil instead of lead mixing oil may be used. The quantity should be lowered to 1½ gallons per 100 pounds of soft paste and 1¾ gallons for heavy paste.

†If the floor is of hard wood, use ½ gallon less linseed oil in this formula.

Pure turpentine	2¼ gallons	2½ gallons
(_____) liquid drier	*1 pint	*1 pint

The above formula makes 8½ gallons of paint which covers about 600 square feet per gallon, one coat.

Formula (20)

Second Coat—Wood Floors

Materials	Soft Paste	Heavy Paste
(_____) white lead	100 pounds	100 pounds
(_____) linseed oil	½ gallon	½ gallon
Pure turpentine	2¼ gallons	2½ gallons
(_____) liquid drier	½ pint	½ pint

The above formula makes 6¼ gallons of paint which covers about 700 square feet per gallon, one coat.

Formula (21)

Third Coat—Wood Floors

Materials	Soft Paste	Heavy Paste
(_____) white lead	100 pounds	100 pounds
(_____) linseed oil	½ gallon	½ gallon
Pure turpentine	¾ gallon	1 gallon
†Floor varnish	1 gallon	1 gallon
(_____) liquid drier	½ pint	½ pint

The above formula makes 5¾ gallons of paint which covers about 700 square feet per gallon, one coat.

Formula (22)

Underside of Porch Floors

Materials	Soft Paste	Heavy Paste
(_____) white lead	100 pounds	100 pounds
(_____) linseed oil	3 gallons	3 gallons
Pure turpentine		1 quart
(_____) liquid drier	1 pint	1 pint

The above formula makes 6¼ gallons of paint which covers about 600 square feet per gallon, one coat.

7. Painting Concrete Floors. (a) New concrete floors shall be aged at least six months before being painted. If necessary to paint before that time, they may be aged artificially by washing with a solution of two pounds of zinc sulphate to a gallon of water.

(b) Previously painted concrete floors shall be wire-brushed to remove all loose paint.

(c) All work shall be allowed to dry at least four days before the next coat is applied.

---

*When boiled oil is used, reduce the drier to ½ pint.
†If the floor is exposed to the weather, use spar varnish instead of a floor varnish.

(d) Unpainted concrete floors shall be primed with Formula (23) and receive two additional coats, using Formula (24) for the second coat and finished as specified in Paragraph (e). (Previously painted floors do not require the priming coat.)

(e) (Here specify whether floors are to be finished with floor enamel or waxed or varnished. If waxing or varnishing is specified, a third coat of paint mixed according to Formula (24) should first be applied.)

(f) (The undercoat of paint should be brought to an approximate match with the desired finish coat color by the addition of the necessary tinting materials. Specifications of colors should be stated here.)

Formula (23)

Priming Coat—Concrete Floors

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	*4 to 5 gals.	*4 to 5 gals.

The above formula makes 7 to 8 gallons of paint which covers about 200 square feet per gallon, one coat.

Formula (24)

Second Coat—Concrete Floors

Materials	Soft Paste	Heavy Paste
(_____) white lead.....	100 pounds	100 pounds
(_____) lead mixing oil.....	*3 to 4 gals.	*3 to 4 gals.

The above formula makes 6 to 7 gallons of paint which covers about 400 square feet per gallon, one coat.

8. **Painting Metal.** (a) (Here list and describe surfaces to be painted.)

(b) All metal surfaces before priming shall be cleaned thoroughly with steel scrapers, wire brushes or by means of sandblasting where necessary.

(c) Galvanized iron, or all metal surfaces where solder fluids have been used, shall be carefully cleansed with petroleum spirits before any paint is applied.

(d) All metal work shall receive three coats of paint as follows: Here specify paint to be used for each coat; writing in the formulas (_____) if paste re-lead is used; designating by name and number in the case of the (_____) liquid red lead paints. If a light-colored finish is wanted on exterior metal, specify for the second and third coat Formulas (2) and (3), respectively. If a light-colored finish is desired on interior metal, specify for the second and third coat, Formulas (16) and (17), respectively.

Formula (25)

Priming Coat—Metal Surfaces
(Orange-Red)

Materials	Quantities
(_____) paste red lead.....	100 pounds

*The minimum amount of lead mixing oil should be used when the maximum amount of hiding is wanted.

(_____) raw linseed oil	1⅞ gals.
Pure turpentine	1½ pints
(_____) liquid drier	1½ pints

The above formula makes 4½ gallons of paint which covers about 600 square feet per gallon, one coat. This paint weighs 26.1 pounds per gallon and contains 33 pounds of dry red lead to the gallon of oil.

or

(_____) Liquid Red Lead (1)
(Orange-Red)

This paint weighs 28 pounds per gallon, contains 33 pounds of dry red lead to the gallon of oil and covers about 600 square feet per gallon, one coat.

Formula (26)

Second Coat—Metal Surfaces
(Light Brown)

Materials	Quantities
(_____) paste red lead	100 pounds
(_____) linseed oil	1⅞ gals.
(_____) lampblack	¾ pint
Pure turpentine	1½ pints
(_____) liquid drier	1½ pints

The above formula makes 4⅝ gallons of paint which weighs 25.9 pounds per gallon and covers about 600 square feet per gallon, one coat.

or

(_____) Liquid Red Lead (6)
(Light Brown)

This paint weighs 26.8 pounds per gallon and covers about 600 square feet per gallon, one coat.

Formula (27)

Third Coat—Metal Surfaces
(Black)

Materials	Quantities
(_____) paste red lead	25 pounds
(_____) lampblack	1⅞ gals.
(_____) C. P. Prussian blue	½ gallon
(_____) linseed oil	2¼ gallons
Pure turpentine	3 pints
(_____) liquid drier	3 pints

The above formula makes 6 gallons of paint which weighs 11.6 pounds per gallon and covers about 700 square feet per gallon, one coat.

or

(_____) Liquid Red Lead (5)
(Black)

This paint weighs 11.6 pounds per gallon and covers about 700 square feet per gallon, using one coat. Note: The red-lead priming coats offered in these specifications are mixed on the basis of 33 pounds of dry red lead to

a gallon of linseed oil. Experience has shown that a primer of this composition gives maximum durability and service, particularly where exposure conditions are severe as in warm, moist climates or near the seacoast.

If, however, exposure conditions are not so severe, it is frequently possible to use a lighter weight primer containing a lower percentage of pigment and secure perfectly satisfactory results.

8A. **Painting Metal when Quick Drying is Required.** Whenever conditions demand quick drying (_____) Quick-Drying Red Lead Primer should be specified.

One quick-drying red lead primer is a straight red lead paint weighing 19.3 pounds to the gallon. Its quick drying properties are obtained through the use of a synthetic resin vehicle. It dries for recoating in from two to six hours. It is specially adapted for use in painting ships, water tanks and other equipment which cannot be conveniently kept out of service for an extended period.

Quick-drying red lead primer dries to a hard, firm, yet elastic film, uniform in thickness. It adheres tightly to metal, holds well the paint coats applied over it, and will stand severe rubbing. On exposure, it is resistant to the softening action of water. It may be used for all coats. For inspection purposes, succeeding coats can be tinted to brown by the addition of from ⅛ to ½ pint of lampblack per gallon. If the proportion is increased beyond ½ pint to a gallon, the lampblack should be ground in japan.

Summary. As previously explained only those parts of the foregoing typical specifications need be used on each job as are necessary. For example, if the building for which specifications are being written has brick exterior walls, then those parts of the typical specification form which deal with exterior wood walls need not be employed. For the average residence the written specifications for painting and finishing need not be over two or three typewritten pages. However, the complete forms should be used as a check list to assure no items are left out.

The specifications where enamels, lacquers, japans, tinting, calcimining, etc., are involved are prepared in like manner.

*READY-TO-USE PAINT SPECIFICATIONS

1. General.

(a) The painting contractor shall read and be governed by the general conditions at the head of the complete specifications for this project.

(b) The contractor agrees to save the owner harmless from all liens or damage arising from or caused by this work, to carry Liability Insurance and Workmen's Compensation Insurance for all workmen.

(c) The following specifications cover the complete painting and finishing of all wood, plaster, and unfinished metal throughout the interior and exterior of the building except as otherwise specified. Screens and storm sash are not included as a part of this contract.

(d) All materials used on the job shall be stored in a single place designated by the architect or owner. Any oily rags, waste, etc., must be removed from the building every night and every precaution taken to avoid spontaneous combustion.

*Courtesy Pratt & Lambert.

(e) If woodwork or other surface to be finished cannot be put in proper condition for finishing by customary cleaning, sanding and puttying operations, the contractor shall immediately notify the architect or owner in writing or assume responsibility for any unsatisfactory finish resulting.

2. **Materials.**

(a) All materials used on the work shall be exactly as hereafter specified in brand and quality. No claim by the contractor as to the unsuitability or unavailability of any material specified, or his inability to produce first-class work with same, will be entertained, unless such claims are made in writing and submitted with his bid. All paints, varnishes, enamels, lacquers, stains, paste fillers and similiar materials must be delivered at the building in the original containers with the seals unbroken and labels intact.

(b) All painting materials, such as linseed oil, shellac, turpentine, shall be pure and of the highest quality and shall bear an identifying label on the container, and no unlabeled containers of materials will be brought on the job.

(c) No materials shall be changed or thinned in any way excepting as may be indicated by the manufacturer's label on the container.

(d) All colors shall be in the manufacturer's tinted colors as selected by architect or owner.

3. **Workmanship.**

(a) The workmanship shall be of the very best and all materials shall be evenly spread and smoothly flowed on without runs or sags by skilled mechanics.

(b) All surfaces to be painted shall be wiped clean of loose dirt by a cloth or a stiff brush before painting.

(c) All knots and sappy spots shall first be touched up with pure shellac where the finish calls for paint or enamel.

(d) All necessary puttying of nail holes, cracks, etc., shall be done after the first coat with a pure linseed oil putty containing at least 50% white lead and of the approximate color of the finish.

(e) All metal surfaces shall first be washed with benzine to remove any dirt or grease before applying materials. Where rust appears, it shall be wire brushed or sandpapered clean before painting.

(f) All galvanized metal surfaces shall be prepared for painting by treating with Lithoform according to manufacturer's directions or with a solution of 2 lbs. of copper sulphate to the gallon of water. After copper sulphate has dried, scrub with a stiff brush and clear water. Copper surfaces shall be left unfinished.

(g) Before application of priming coat to plaster, all cracks and abrasions in plaster surfaces and openings adjoining trim shall be cut out as required, then filled, rough surfaces sanded smooth, and sealed.

(h) All suction spots or "hot spots" in plaster or cement which are noticeable after the application of the first coat, shall be neutralized or touched up before applying the second coat, to produce an even result in the finish coat. The contractor shall get color schedules for rooms before applying priming coat on plaster. The priming coat on plaster shall be tinted to the same shade as the second coat.

(i) Undercoats of paint and enamel shall be tinted to the approximate shade of the final coats.

(j) All woodwork and metal surfaces calling for enamel or varnish finish shall be sanded between coats with fine sandpaper to produce an even, smooth finish.

(k) All coats shall be bone dry before applying succeeding coats.

(l) Interior trim shall be back-primed before installation.

(m) Exterior trim shall be primed on all sides before installation.

(n) Pulley stiles shall be oiled with boiled linseed oil.

(o) Tops, bottoms, and edges of doors shall be finished same as balance of doors after they are fitted by the carpenter.

(p) All closets shall be finished the same as adjoining rooms, except that the walls and ceilings shall be given the flowing flat finish—2 coats. The insides of all cabinets shall be given one coat of primer and one coat of flat paint. The insides of all drawers shall be given two coats of pure white shellac.

(r) Exterior painting shall not be done when surface is damp, or during rainy or frosty weather.

(s) The painting contractor shall not only protect his work at all times but shall also protect all adjacent work and materials by suitable covering or other method during the progress of his work. Upon completion of the work, he shall remove all paint and varnish spots from the floors, glass and other surfaces. He shall remove from the premises all rubbish and accumulated materials of whatever nature not caused by other trades and shall leave his work in a clean, orderly and acceptable condition.

EXTERIOR WOOD SURFACES

Exterior Varnish Finish

1.	*STAINED VARNISH FINISH (Birch, Pine, Fir, etc.)*	Exterior wood surfaces to be stained and varnished shall be given— 1 coat (_____)* oil stain. 3 coats (_____) quick drying spar varnish.
2.	*FILLED VARNISH FINISH (Oak, Walnut, etc.)*	Exterior wood surfaces to be filled and varnished shall be given— 1 coat (_____) paste filler. 3 coats (_____) quick drying spar varnish.

Exterior Enamel Finish

3.	*GLOSS ENAMEL FINISH*	Exterior wood surfaces to be gloss enamel shall be given— 1 coat (_____) house paint exterior primer thinned with one quart of turpentine to the gallon of primer. 1 coat (_____) enamel undercoating. 2 coats (_____) enamel gloss.

* Insert manufacturer's name.

4. *EGGSHELL ENAMEL FINISH*

Exterior wood surfaces to be eggshell enamel shall be given—

1 coat (_____) house paint exterior primer thinned with one quart of turpentine to each gallon of primer.
1 coat (_____) enamel undercoating.
1 coat (_____) enamel gloss.
1 coat (_____) enamel eggshell.

Exterior Paint Finish

5. *HOUSE PAINT (Colors other than Dark Greens, Brown, Maroon, Red and Black)*

Exterior wood surfaces to be painted in indicated colors shall be given—

1 coat (_____) house paint exterior primer thinned with one quart of turpentine to the gallon of primer.
1 coat (_____) house paint thinned with one pint of turpentine to the gallon of paint.
1 coat (_____) house paint as it comes in the can.

6. *HOUSE PAINT (Dark Greens, Brown, Maroon, Red and Black)*

Exterior wood surfaces to be painted in indicated colors shall be given—

1 coat (_____) house paint exterior primer thinned with one quart of turpentine to the gallon of primer.
1 coat (_____) house paint light lead or other suitable tint, thinned with one pint of turpentine to the gallon of paint.
1 coat (_____) house paint as it comes in the can.

7. *SHINGLE STAIN*

Shingles shall be given—

1 coat (_____) creosote shingle stain (by dipping shingles before laying).
1 coat (_____) creosote shingle stain (after shingles are laid).

8. *STAINED EXTERIOR BEAMS (Half timber construction)*

Stained exterior beams used in half timber construction shall be given—

1 coat (_____) oil stain (do not wipe off).
1 coat (_____) (wipe thoroughly according to directions).

EXTERIOR METAL SURFACES

9. *INTERIOR OF GUTTERS*

The interior of gutters shall be given—

1 coat (_____) red lead metal primer.

10. *GLOSS ENAMEL FINISH*

Exterior metal surfaces to be gloss enamel shall be given—
1 coat (_____) red lead metal primer.
1 coat (_____) enamel undercoating.
2 coats (_____) enamel gloss.

11. *EGGSHELL ENAMEL FINISH*

Exterior metal surfaces to be eggshell enamel shall be given—
1 coat (_____) red lead metal primer
1 coat (_____) enamel undercoating.
1 coat (_____) enamel eggshell.

12. *HOUSE PAINT (Colors other than Dark Greens, Brown, Maroon, Red and Black)*

Exterior metal surfaces to be painted in indicated colors shall be given—
1 coat (_____) red lead metal primer.
1 coat (_____) house paint thinned with 1 pint turpentine to the gallon of paint.
1 coat (_____) house paint as it comes in the can.

13. *HOUSE PAINT (Dark Greens, Brown, Maroon, Red and Black)*

Exterior metal surfaces to be painted in indicated colors shall be given—
1 coat (_____) red lead metal primer.
1 coat (_____) house paint light lead or other suitable tint thinned with 1 pint turpentine to the gallon of paint.
1 coat (_____) house paint as it comes in the can.

EXTERIOR BRICK, CONCRETE, STUCCO, ETC.

14. *CEMENT COATING*

All exterior, brick, concrete or stucco surfaces shall be given—
1 coat (_____) exterior cement coating reduced with 1 quart exterior cement coating reduced to 1 gallon of cement coating.
1 coat (_____) exterior cement coating as it comes in the can.

EXTERIOR FLOORS

(Wood, Concrete, etc.)

15. *FLOOR ENAMEL*

All exterior floors shall be given—
1 coat (_____) floor enamel reduced with 1 quart boiled linseed oil to 1 gallon of enamel.
1 coat (_____) floor enamel as it comes in the can.

INTERIOR

Floors

16. *OAK GLOSS FINISH*
Filled, 3 coats

Oak floors and stairs shall be given—
1 coat (_____) paste filler.
3 coats (_____) quick drying floor varnish clear gloss.
For close grained woods such as pine, maple and fir, substitute (_____) oil stain for paste filler.

17. *OAK GLOSS FINISH*
Filled, 2 coats

Oak floors and stairs shall be given—
1 coat (_____) paste filler.
2 coats (_____) quick drying floor varnish clear gloss.
For close grained woods such as pine, maple, and fir, substitute (_____) oil stain for paste filler.

18. *OAK SATIN FINISH*
Filled, 3 coats

Oak floors and stairs shall be given—
1 coat (_____) paste filler.
3 coats (_____) quick drying floor varnish satin finish.
For close grained woods, such as pine, maple, and fir, substitute (_____) oil stain for paste filler.

19. *OAK SATIN FINISH*
Filled, 2 coats

Oak floors and stairs shall be given—
1 coat (_____) paste filler.
3 coats (_____) quick drying floor varnish satin finish.
For close grained woods, such as pine, maple, and fir, substitute (_____) oil stain for paste filler.

TRIM

20. *STAINED VARNISH SATIN FINISH*

Wood surfaces calling for stained varnish satin finish shall be given—
1 coat (_____) oil stain.
1 coat pure white shellac.
2 coats (_____) quick drying floor varnish satin finish.

21. *STAINED VARNISH DULL FINISH*

Wood surfaces calling for stained varnish dull finish shall be given—
1 coat (_____) oil stain.
1 coat pure white shellac.
1 coat (_____) quick drying floor varnish dull finish.

Window sills shall be given—
1 coat quick drying spar varnish preceding the dull finish.

22. *KNOTTY PINE FINISH*

For knotty pine finish the following specification shall be used:
Spring the wood with water, and sand smooth.
1 coat (_____) old pine acid stain No. ___.
1 coat pure white shellac.
1 coat (_____) quick drying floor varnish dull finish.
Window sills shall be given—
1 coat quick drying spar varnish preceding the dull finish.

ENAMEL FINISHES

23. *GLOSS ENAMEL 4 coats*

Wood surfaces calling for a 4-coat gloss enamel finish shall be given—
1 coat (_____) enamel undercoating reduced with 1 quart boiled linseed oil to the gallon of undercoating.
1 coat (_____) enamel undercoating.
2 coats (_____) enamel gloss.

24. *GLOSS ENAMEL 3 coats*

Wood surfaces calling for a 3-coat gloss enamel finish shall be given—
1 coat (_____) enamel undercoating reduced with 1 quart boiled linseed oil to the gallon of undercoating.
1 coat equal parts (_____) enamel undercoating and enamel gloss.
1 coat (_____) enamel gloss.

25. *EGGSHELL ENAMEL 4 coats*

Wood surfaces calling for a 4-coat eggshell enamel finish shall be given—
1 coat (_____) enamel undercoating reduced with 1 quart boiled linseed oil to the gallon of undercoating.
1 coat (_____) enamel undercoating.
1 coat (_____) enamel gloss.
1 coat (_____) enamel eggshell.

26. *EGGSHELL ENAMEL 3 coats*

Wood surfaces calling for a 3-coat eggshell enamel finish shall be given—
1 coat (_____) enamel undercoating reduced with 1 quart boiled linseed oil to the gallon of undercoating.
1 coat equal parts (_____) enamel undercoating and enamel gloss.
1 coat (_____) enamel eggshell.

METAL SURFACES

(Radiators, Exposed Piping, Etc.)

27. *ENAMEL FINISH* — Use Specification 24 or 26.

28. *ALUMINUM PAINT* — Metal surfaces calling for aluminum paint shall be given—
2 coats (_____) interior aluminum paint.

PLASTER SURFACES

29. *GLOSS ENAMEL FINISH*
3 coats
Plaster surfaces calling for gloss enamel finish shall be given—
1 coat (_____) double-duty primer.
1 coat (_____) enamel undercoating.
1 coat (_____) enamel gloss.

30. *FLOWING FLAT FINISH*
2 coats
Plaster surfaces calling for flowing flat finish shall be given—
1 coat (_____) double-duty primer.
1 coat (_____) flowing flat.

31. *SEMI-GLOSS FINISH*
2 coats
Plaster surfaces calling for semi-gloss finish shall be given—
1 coat (_____) double-duty primer
1 coat (_____).

32. *STIPPLING EGGSHELL FINISH*
2 coats
Plaster surfaces calling for stippling eggshell finish shall be given—
1 coat (_____) double-duty primer
1 coat (_____) stippling eggshell, which shall be stippled.

33. *STIPPLING EGGSHELL FINISH*
2 coats and Starch
Plaster surfaces calling for stippling eggshell, 2 coats, and starched, shall be given—
1 coat (_____) double-duty primer
1 coat (_____) stippling eggshell, which shall be stippled
1 coat boiled starch, which shall be stippled.

34. *WALL PAPER* — Surfaces to be papered shall be sized with glue size and then wall papered with a butt edge joint and with pattern matching.

GOOD PAINT NOT ONLY BRIGHTENS THE EXTERIOR, BUT PRESERVES IT AS WELL

Courtesy of The Eagle-Picher Sales Company, Cincinnati, Ohio

CHAPTER III

*MIXING PAINTS

The most important part of any painting or finishing job begins with the mixing of the paint to be used. Improperly mixed paints cannot be applied properly and, therefore, they do not serve the main purposes of paint, as outlined in Chapter I. A paint having too much white lead or too much oil, or where the two have not been well mixed, results in poor or spotty coverage. Too little white lead streaks, and gives an undesirable appearance. The same thing holds true for paints wherein red lead is used. Driers, improperly used, may easily ruin paint. In the past many laymen and even some painters have not understood the importance of proper proportioning or formulation of materials and proper mixing with the result that the surfaces covered did not have the necessary protection nor the desired appearance. Therefore, if the person using paint would go about its preparation with a studied carefulness, it would mean not only economy in the buying of materials but it would mean also time well spent.

Ready-to-use paints come already mixed but they sometimes require some altering to fit conditions. Therefore, these instructions apply equally as well to ready-to-use and mixed-on-the-job paints. It is well for the beginner to understand paint formulation no matter how he purchases the paint.

Materials. There is one rule in regard to the buying of paints that has proved important and sound. The rule is simple and can be stated as follows: *Always buy good materials.* Do not substitute poor paint for good paint for it means usually a corresponding decrease in the life of the paint job and lessens the amount of protection and the desired appearance. Purchasing poor paint materials is poor economy.

†**Formulas.** The formulas presented in this volume are typical. They are herein used as examples. However, their derivation includes long years of research and experience, and if the reader desires

*See Chapter VII for mixing aluminum paints.
†Courtesy of National Lead Company.

to use these formulas for mixing paints it would be safe to do so and he would obtain good results. Or, he could use ready-to-use paints. Ready-to-use paint can be purchased for the same needs as herein explained. The formulas are presented only to illustrate the general mixture of paints used for the various purposes and to teach the beginning painters the basic principles. Also, the formulas are presented to show how paint is mixed in cases where ready mixed paint is not obtainable or where mixed-on-the-job paint is specified in the specifications.

The typical specifications, as shown in Chapter II, or specifications nearly like them, may either specify mixed-on-the-job paint or ready-to-use paint. Either one is used extensively.

The formulas presented herein will give excellent results in most localities and on most types of surfaces. Also, the general types of ready-to-use paints will give excellent results. However, it is recognized that the best average formulas or the best ready-to-use paints do not meet always exact conditions. There may be conditions pertaining to a particular job requiring some special formulation for the paint or that the paint in some way or another be changed from the average or standard. Experience is the best guide to these adjustments, but the few general facts which follow will be helpful also.

Priming of Exterior Woods. For this particular type of painting, Formula (1) in Chapter II will give excellent results or the ready-to-use paint may be purchased to give the same results.

The first coat of paint on a surface that has never been painted or from which all previous paint has been removed is called the priming coat. It is the foundation for all succeeding coats of paint and therefore its proper formulation and application is of importance.

If we were to look at a wooden surface through a powerful microscope, we would see that the surface was made up of almost countless small openings or pores. As explained in Chapter I, these pores should be sealed by paint to preserve the wood. There is another reason or consideration relative to these pores which pertains to the anchoring of paint to the surface. The priming coat must enter these openings or pores and actually key itself on the surface. This is accomplished by filling the open pores or cells. Such a paint, therefore, must contain enough linseed oil to satisfy the porosity and enough turpentine to bring about proper penetration.

It stands to reason that if a surface is exceptionally porous or in other words if a wood to be painted has a porous surface, more linseed oil and turpentine should be added to the priming coat being applied. This is one case in which standard formulas or standard ready-to-use paints must be altered if they are to be used to the best advantage. The necessary altering can be done easily by the painter. He must use his good judgment as to the amount of linseed oil and turpentine to add to the paint.

Another point to consider is that woods, such as cedar, redwood, and white pine are more absorbent than yellow pine or Douglas fir. Therefore, whenever such woods are encountered, the painter should adjust the linseed oil and turpentine to take care of the differences. Yellow pine and Douglas fir, for example, require less linseed oil to satisfy porosity and more turpentine to penetrate the rather pitchy surface. A wooden surface of a type containing little or no pitch would not require nearly the amount of turpentine because penetration would be easier.

First Coat for Repaint Work. When repainting an old surface, it must be remembered that the surface porosity is not as great as that on new surfaces. The reason for this is that the original paint has filled up the pores to some extent. Any soaking up of oil that happens in general is done by the old paint. Therefore, for first coat work to be used on old surfaces more linseed oil and turpentine is used than for first coat work on new surfaces.

Another way to remember the above explanation is to keep in mind that there is more linseed oil and turpentine in the first coat for old surfaces than in the second coat for new surfaces.

Formula (4) in Chapter II shows typical formulation for first coat work on repaint surfaces. Ready-to-use paint having the same qualities can also be purchased.

If the painter encounters old wood or old surfaces which he thinks, or by trial finds to be, greatly dry and, therefore, more than usually absorbent, he sometimes adds spar varnish to the first coat. Sometimes in dry, old surfaces the amount of spar varnish required is from one-quarter to one-third of the total vehicle by volume.

Another way to treat such a surface is to apply an exceptionally heavy coat of paint without any special materials being added to it.

Second Coat for Exterior Woods. The second coat is known gen-

erally as the body coat. Most paints including mixed-on-the-job and ready-to-use varieties are made so as to give the surface a rather hard but flat surface. In some cases a semi-flat surface is desirable. Formula (2) in Chapter II shows such a paint, or as previously stated such a paint can be purchased ready to use.

Not all woods act exactly the same under the first coat of paint. The weather, also, has something to do with it. Therefore, if the priming coat of paint does not seem to have filled the pores completely or in other words done away with all absorption, more linseed oil may be added to the body coat. The main idea of this body coat is to keep it harder and less elastic than the final or third coat of paint.

Final Coat for Exterior Wood. The final coat of paint for exterior wood is illustrated typically by Formula (3) of Chapter II. Most paints are formulated somewhat similar to this one.

The final coat generally should have a gloss. To produce this gloss, an ample amount of linseed oil should be used. On the other hand, too much linseed oil would soften the surface too much. For normal conditions no more than 3 gallons of oil to 100 pounds of white lead are used.

Too much linseed oil also may cause chalking especially in warm climates or on the southern side of a residence or other surface exposed to the summer sun. The gloss most desirable for exterior surfaces is not a high gloss but a medium gloss.

If stand-oil is used, an adjustment of the formula for the finishing coat is necessary because this oil is more viscous than the raw linseed oil.

Occasionally in third coat work the paint becomes a little hard to brush and in such cases about a quart of turpentine can be added to the amount given in Formula (3) of Chapter II.

In the fall and early spring, the practice of adding this extra quart of turpentine is especially desirable. If the weather is extremely cold, say down to the minimum recommended painting temperature of 50 degrees, 2 quarts of turpentine may even be added.

Wooden Shingles on Walls. Approximately the same reasoning is required for shingles used as siding as is required for ordinary wood, as already explained. For this purpose the priming coat can be Formula (1) or a ready-to-use paint of a similar nature.

For the second coat applied to side wall shingles, a paint formulated according to the following formula could be used.

White Lead—100 lbs.
Linseed Oil—2 gal.
Turpentine—¾ gal.
Liquid Drier—1 pt.

The above formula makes approximately 6 gallons of paint which will cover about 600 square feet per gallon.

The third coat as applied to shingles needs no special consideration and Formula (3) in Chapter II or a ready mixed paint of about the same nature could be used.

There are, also, many other types of paints made for applying to shingle surfaces most of which are bought ready to use.

Staining Shingles. In cases where it is desired to stain shingles without using regular stain and without using any white lead, a formula or stain is used consisting of enough tinting to sufficiently stain the shingles the desired color plus a mixture of one part flatting oil and two parts boiled linseed oil. Or, in other cases turpentine may be used in place of the flatting oil. The desired tint or colors can be readily obtained by adding color in oil as required to each gallon of the oil vehicle.

For example, to obtain a gray stain, it would be necessary to use white lead with just a touch of lampblack. Most painters use a formula of 12½ pounds of white lead with just a touch of lampblack. Then, if a deep red brown is required, one pint of Indian red coloring is added for each gallon of oil vehicle. A bright red is obtained by putting one pint of Venetian red for every gallon of vehicle in the stain. A permanent cream is obtained by using ¾ pint chromium oxide.

Creosote oil has been used extensively for staining shingles. If it has been used prior to the application of stains, as have been just described, it would be unwise to try staining with these stains, because the creosote oil likely would bleed through the new surfacing.

Stucco, Concrete, Brick, and Stone. There are numerous ready-to-use paints obtainable for the painting of these surfaces, but if the painter is mixing his own paint he should remember that the priming coat must contain some raw or boiled linseed oil. Approxi-

mately, two gallons of linseed oil should be substituted for an equal amount of the lead mixing oil called for in Formula (6), Chapter II. The second coat can be mixed according to Formula (7) and for the final coat Formulas (7), (8), (9), or (10) may be used.

Interior Work. For interior work, as with outside work, some discretion is necessary in reducing the quality of linseed oil for surfaces or woods which are less absorbent, as yellow pine, white spruce, cedar, hemlock, etc. The three generally used coats for interior woods are shown in Formulas (11), (12), (13), and (14) in Chapter II.

If the surface has been painted before and the original paint is in fairly good condition, the priming coat for the new painting can be omitted and only the second and third coats applied.

In cases where the finishing coat is to be enamel, the primer and second coat can be used, as already explained. Oftentimes painters tint the second coat almost to the shade of the enamel they are using. This helps to give a good covering and to give the enamel finish a better appearance.

For extra fine enameling, sometimes three coats of flat paint or paint as given in Formulas (11) and (12) are used first. In this case, the priming coat is applied first and then two coats of what would ordinarily be second coat are applied. Then the second coat is mixed with some of the enamel and is applied as a fourth coat and the fifth coat may consist of pure enamel. The painter must know how many coats of paint are necessary and just what paints to use and their formulation.

Coloring Paint. When white lead and linseed oil are mixed together, a white paint results. In fact, all of the typical formulas shown in Chapter II give white paint. There are one or two exceptions to this rule but most of the formulas as applied to wood floors, concrete, etc., give white paint as the formula stands. It is not often that pure white paint is desired and when the coloring or tinting is necessary this can be accomplished easily by using the colors in oil.

In using the colors in oil, it is best to experiment by putting in little of the coloring material at a time. Next, take out a little of the white paint and mix the coloring material in it thoroughly and then pour that into the main batch of paint. The inexperienced painter always can keep up this process of adding a little coloring at a time until he has accomplished the desired color.

Where colored paints are used, especially if they are mixed on the job, it is a good plan to mix enough paint the first time for painting the entire job, because it is a difficult matter to match exactly an original color.

Many of the ready-to-use paints may be purchased in a variety of colors which is an aid to the painter, as he does not have to worry then about the coloring.

A few typical color formulas are given as follows: The amounts given in each of the formulas or for each color are based on the use of 100 pounds of white lead, as given in the formulas throughout Chapter II.

For exterior coloring a lemon yellow is made by adding ¼ pint

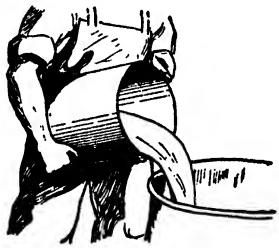


Fig. 1. Soft Paste Being Poured into a Container

C. P. lemon chrome yellow; a buff by adding ½ gallon raw sienna; pale ivory by adding 1/16 pint C. P. medium chrome yellow; and shutter blue by adding ½ gallon C. P. Prussian blue.

For interior colors a buff is made by adding ½ pint raw sienna; an ivory is made the same way as explained for exterior coloring; a tan by adding ½ gallon French ochre; a peach color by adding ¼ pint C. P. orange chrome yellow; and an orchid by adding ¼ pint orchid pincer.

Mixing Paints on the Job. In this explanation it is assumed that a white lead paint is being mixed. After opening the can or drum of white lead it should be stirred just enough to thoroughly mix in the oil that may have come to the surface. Then enough of the soft paste may be poured out as illustrated in Fig. 1.

If the paint is being made by using a heavy paste of white lead, the process is somewhat the same except that the lead must be first broken up. This can be accomplished usually by stirring in

the linseed oil a little at a time until a workable or fairly soft paste is obtained.

After the soft paste has been poured into a proper bucket or other large can, it can be stirred vigorously, as shown in Fig. 2. This stirring should continue until the paint has an even consistency. The addition of linseed oil is carried on as shown in Fig. 3.

After all the ingredients have been added, the mixture should be stirred carefully until it is mixed thoroughly. The paint may be boxed several times if it is found necessary, as this process is harmless.

If the mixer feels that the paint is at all lumpy, he should strain it through a fine mesh or a piece of cheesecloth folded at least double.

Fig. 2. Soft Paste Being Stirred Vigorously

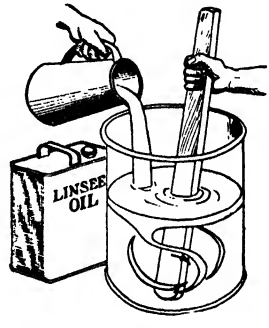


Fig. 3. Pouring Linseed Oil into the Soft Paste

A drier should be added, as given in the various formulas in Chapter II. However, during damp, cool or humid weather, which the painter describes as poor drying conditions, the amount of drier should be increased, but in all events it should not be increased to exceed twice the amount called for in the formulas. It should be kept in mind that a drier should be added to all paints thinned with raw linseed oil as well as linseed oil of the regular or standard type.

A question often asked is, "How long can paint be safely kept without being used?" It is a good plan to mix the paint half a day to a day in advance of its actual use and from then on. If the paint container is kept fully sealed, there is little chance of the paint deteriorating or becoming sappy.

Mixing Red Lead Paint. *Dry Red Lead.* In mixing red lead paint, the process is a trifle different. First, measure out one volume

of the linseed oil and pour a little of this oil on top of the red lead and stir it thoroughly. This pouring of the oil is repeated until the mixture becomes a workable paste. It is a good plan to allow the paste to stand at least one full day and more if possible. This gives the linseed oil an opportunity to wet the surfaces of the particles of red lead thoroughly. The remainder of the linseed oil and turpentine and drier may be added somewhat before the paint is to be used. It should be stirred thoroughly and in the event of any lumps appearing, it should be strained, as advised for white lead paint. Boxing the paint is, also, a good plan and this should be done about 12 or 15 times.

If paste red lead is used, the entire amount called for can be removed from the keg in which it comes and the required amount of linseed oil added slowly, stirring continually. The turpentine and drier may be added whenever the mixture has become fairly workable and consistent. Here again boxing is of value.

Mixing Ready-to-Use Paint. Before opening a can of ready-to-use paint, the painter should shake the can thoroughly and vigorously, as illustrated at (1) in Fig. 4. The more shaking that is done at this time the better. At (2) is shown the method of opening the can. The entire top should be removed. At (3) is shown the manner of pouring off most of the oil that has come to the top in the can. This can be poured off into another bucket to await its use. At (4) is shown the method of stirring the pigment up thoroughly. Then at (5) the method is illustrated of pouring back the oil that was taken off the top. This is poured back slowly and stirred continually. After a considerable amount of stirring has taken place, boxing can be carried on as illustrated at (6). The more stirring and the more boxing that is carried on, the better the paint will be.

If any tinting or coloring of ready-to-use paint must be done, it can be done after the mixing has been accomplished. As previously explained, it is advised that the beginner add very little coloring at a time and that it be added to a small amount of paint and thoroughly stirred and then this returned to the main supply. Frequent testing will prevent getting the tinting or coloring too dark. This is not a difficult thing to do after one has had experience in carrying on such processes.

Coloring Calcimine. Calcimine is purchased in a powder form

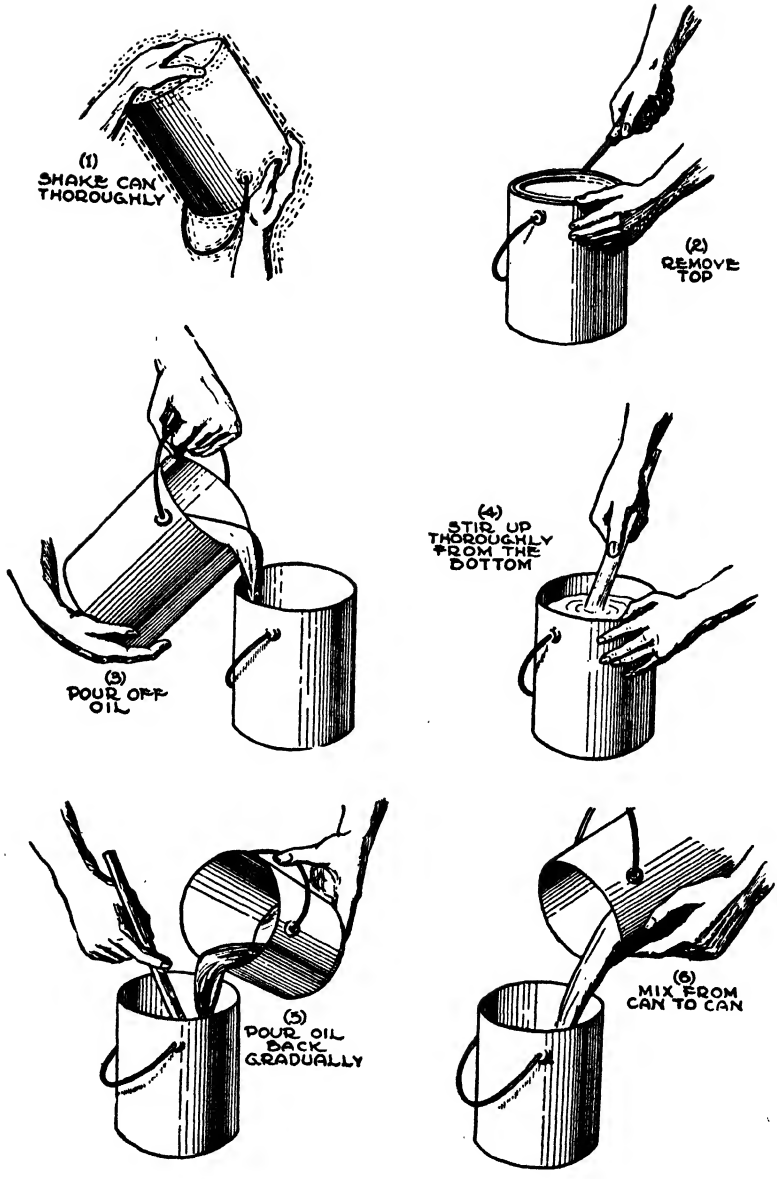


Fig. 4. Mixing Ready-to-Use Paint

and must be mixed by the painter prior to the time he wishes to use it. Some calcimines come in various colors and others are white.

In mixing the calcimine just prior to the time it is to be used, most painters take two quarts of hot water to 5 pounds of calcimine. The mixing is done generally in a bucket. This mixture is mixed thoroughly and then allowed to stand until it is something like jelly. After this, enough cold water may be added to make the solution a little thinner than ordinary paint for ease in applying. Another formula frequently used for the mixing of calcimine is to pour four pints of warm water into a container having 5 pounds of calcimine in it. This is stirred thoroughly until all lumps have disappeared and until it has an even consistency. This mix can be then left standing for thirty minutes after which it is necessary to again stir it. It can then be thinned to painting consistency by the addition of one-half to one pint of water. When 5 pounds of the powder is being used, it is not wise to use more than 5 pints of water. If the mixture contains any lumps, it is advisable to strain it through one fold of cheesecloth.

Calcimine may be tinted readily to any shade or color by the addition of the powdered coloring material. This powder or coloring material can be purchased with the regular calcimine. Some coloring material to be used with calcimine comes as a paste rather than as a powder.

If the coloring material comes as a paste, it should be thinned by adding one part water to two parts paste. Then this can be stirred into the calcimine until the desired shade is developed.

If the coloring material is in the form of powder, it should be stirred with water to a thin paste-like consistency and then added slowly to the calcimine, stirring continually.

There is a tendency for beginners to add too much color. Calcimine when wet looks somewhat different than when dry. To overcome any tendency to add too much coloring a simple experiment can be carried on several times during the mixing, which is especially beneficial to the beginner.

After some coloring has been added to the calcimine, a sample of it can be painted on a piece of white paper and this piece of paper then held over a gas stove flame so that it will dry quickly. As soon as it has dried, the final color can be noted on the paper and if it is too light then some more of the coloring material can be added to the calcimine

and the process repeated until such time as the desired color has been obtained.

It is essential that enough calcimine, especially where it is being colored, be mixed at one time to do the entire job at hand, because it is unlikely that a second batch could be mixed and colored exactly the same shade as the first batch.

In warm and humid weather, it is best to strain the calcimine while still warm, after the original warm water and stirring.

Some calcimines which come already colored can be mixed together to form a third desired color. In such cases the mixing directions are given on the package.

CHAPTER IV

VARNISH, SHELLAC, STAIN AND FILLERS

The application of varnish, shellac, and stain is not difficult and requires but few fundamental rules plus the experience necessary for good results and workmanship. These materials can be purchased ready to use and should always be obtained in good grades because, as previously explained, it is poor economy to purchase cheap materials.

Varnishing. The wood should be dry and clean before varnishing it. Sandpaper can be used to clean the wood and make it smooth. The wood first receives a coat of paste filler if it is in proper condition, and is an open-grained wood. The open-grained woods in most common use are oak, chestnut, and ash. The woods classed as close-grained woods are white pine, maple, birch, yellow pine, whitewood, cherry, and sycamore. These latter do not need filling. If a filler is used, it should be well rubbed in with a short, stiff brush; and when it has set, say in fifteen to thirty minutes, the filler is rubbed off with a handful of excelsior, rubbing across the grain, and rubbing hard, so as to force the filler well into the pores of the wood and then left to stand 24 to 48 hours.

A paste filler must be thinned with turpentine or benzine before using as it is too thick to be used with a brush when purchased. The filler may be stained to any desired color with an oil or varnish stain, which can be purchased in different colors. If a close-grained wood is under treatment and requires staining, this should be the first operation. It is common practice however to finish in the natural color. Stains usually require thinning before using; the amount of thinning will determine the depth of color. Water or acid stains are frequently used, but as they tend to raise the grain of the wood, the surfaces should be slightly sandpapered before the finish is applied.

In cleaning off the filler, be careful to clean out corners and mouldings with properly shaped hardwood sticks; do not use any steel tool.

Where rooms are to be finished in the natural color of the wood, it is a common practice to stain the window-sashes a cherry or light

mahogany stain. Fillers are sometimes used on close-grained woods; but this is not advisable, as they tend to prevent the varnish from obtaining a good hold on the wood.

Next comes the varnishing. Window-sills, jambs, inside blinds, and other surfaces, exposed to the direct rays of the sun, are to be treated as exterior woodwork, and are not varnished with the ordinary interior varnish used on the rest of the work. The floors also are left out of account for the present. The rest of the woodwork receives its first coat of varnish; apply it, as much as possible, with the grain of the wood, brushing it out well in a thin coat. The varnish ought to dry dust free (i.e., so that dust will not stick to it) over night; but at least five days should elapse between coats. When dry, it should be rubbed with curled hair or excelsior just enough to remove the gloss, so that the next coat of varnish will adhere properly; a better result will be had if it is lightly sandpapered with No. 00 sandpaper. The second coat is treated like the first. The third is not sandpapered, but rubbed with curled hair; the fourth or finishing coat may be left with the natural gloss, or, if preferred, it may be rubbed with fine pumice and water to a smooth, dull surface. The varnish dealers sell felt about an inch thick for this purpose. The felt is wet in clean water and a little dry pumice powder dusted on it. The rubbing operation is done with this felt. The varnish must be quite hard and dry before this is attempted. Varnishing, if properly done, is slow work; that is, much time must be allowed for each coat to dry thoroughly.

The varnish which is used on interior woodwork should not dry too quickly; it should dry enough over night so that dust will not stick to it, and in twenty-four hours it should be thoroughly dry. If a chair, for example, were varnished, it would not be entirely safe to sit on the chair for a week. The varnish should, however, finally become free from tack, which it will not do if it is a rosin varnish. It is inadvisable to use a cheap varnish for undercoats; the outer coats will crack if this is done. A good varnish that dries too quickly, such as a rubbing varnish, or one intended for furniture, has not the durability needed for this work. It is economy to use a good varnish. Take for instance an occupied house which was varnished properly eighteen years ago. The varnish is still in fair condition. If the house were sandpapered lightly and one new coat of varnish applied, it would be like new. Cheap rosin varnishes deteriorate rapidly.

Shellac. Interiors are sometimes finished with shellac. This varnish is not used on exterior work, but it is a good varnish for interiors. All varnishes containing oil darken the color of wood; but white shellac is comparatively free from this objection and it is necessary usually to use white shellac for this service. Orange shellac is a dark varnish, and even white shellac darkens with age to an appreciable degree. Orange shellac is more durable than white, and should be used whenever admissible, rather than white. If shellac is made up as heavy as has been described—five pounds to a gallon of alcohol, and this is standard—it should be thinned considerably with alcohol before using on interior woodwork. It must be applied in thin coats, and given plenty of time to dry. If coat after coat were applied even six hours apart, the wood would be covered with a waxy mess which would cause trouble. The first coat sinks rapidly into the wood; a second coat may be applied six hours later; but after that, allow two days at least between coats. Shellac makes a thin coat; so it is necessary to apply a large number of coats, at least twice as many as would be used of oleoresinous varnishes, to get a sufficient thickness of coating. Because of this labor, shellac is an expensive finish; but it is handsome and durable. The treatment of it, as regards rubbing, etc., is the same as has been described for other varnishes.

Shellac is an excellent first coat, except for exterior work, where it should not be used. Of course, wood should be filled before shellacking, the same as for other varnish. Varnish does not, however, wear well over a heavily shellacked surface. Shellac makes a good floor varnish, discoloring the wood very little, and wearing fairly well. After the floor has been well varnished, it will remain in good condition if thin coats of shellac are applied rather frequently—say every month, according to use. After applying one of these thin coats, it will be dry enough to use in an hour. This can be brushed over the floor of an ordinary room in a few minutes with a wide, flat brush. Shellac brushes should be washed out with alcohol immediately after using.

Exterior Varnishing. Varnishes dry more rapidly out of doors than within, so that it is practicable to use more elastic and durable materials. The conditions, in fact, are so severe that the best are not good enough. In the first place, do not use any filler on exterior work; it will probably crumble and come out. Do not use shellac; as

an undercoat exposed to the hot sun, it will soften and blister. Use only the best spar varnish, such as is made for varnishing the spars of yachts; fill the wood with it; sandpaper lightly between coats, just enough so that each succeeding coat will take hold well; finish with a coat well flowed on; and leave it with its natural gloss, which is more lasting than a rubbed surface. This is the treatment given handrails, outside doors, inside blinds, window sills and jambs, and everything exposed to the direct sun. Handrails and outside doors should be refinished every year; varnish will not last on an outside door more than one-twentieth as long as it will on an inside door. Never use interior varnish for outside work.

A method of finishing open-grained interior woodwork, which has been practiced for a few years, consists in first staining the wood with a water-stain. When it is dry, fill the pores of the wood with a paste filler which has been colored by the addition of a pigment. For example, the wood may receive a stain of any dark color, and the wood-filler be mixed with white lead. This shows the open or porous part of the grain in white on a dark background. By using artistic combinations of color in the stain and filler, beautiful effects can be produced. This finish has been used in some of the most handsome and costly public and private buildings. Thus, if a room is to be decorated in green, the woodwork can be made to harmonize with the prevailing color. An oil stain must not be used on the wood, as it will not work well with the filler. The colored filler is applied and rubbed off in the same way that any paste filler is used, and then the varnish is applied over it in the usual way.

Floor Finishing. The primary trouble in keeping floors looking spick-and-span is that people walk on them. If they did not, there would be no trouble at all. Four coats of varnish, having an aggregate thickness of less than one-hundredth of an inch, will not last indefinitely under the wear of heels.

Floors of choice wood are either varnished or waxed. If they are of oak or other open-grained wood, they must be filled with a paste filler; otherwise the varnish is applied directly to the wood. Floor varnish is quicker in drying, and harder than interior finishing varnish, but should not be so hard as to be brittle; rubbing varnish is too hard. If the floor is to be stained, this is done with an oil stain before varnishing; if it is a floor which has previously been varnished

so that the stain will not penetrate the wood, the stain may be mixed with the varnish, although the effect is not good.

Floor wax is not made of beeswax, but of a harder vegetable wax, and is sold by all paint dealers. The floor should receive one coat of shellac; then the floor wax may be rubbed on with a stiff brush. After a few hours of drying, it may be polished by rubbing with a clean cloth or with a heavy, weighted floor brush made for the purpose. It should receive another coat of shellac every week until four or six coats have been applied; after this a little of the floor wax, thinned if necessary with turpentine, should be applied often enough to keep the floor looking well. Alkalies dissolve the wax, therefore in cleaning the floor only a little soap should be used in the water. A wax finish which is kept polished with a polishing brush, is the handsomest surface that can be obtained for a floor and it does not discolor the wood; but it is so slippery that it is somewhat dangerous. Interior trim (except handrails) is sometimes wax-finished. This finish requires a good deal of care, as it is likely to catch dust; otherwise it is handsome and durable.

Old floors which require cleaning and revarnishing should have the old varnish or paint removed by a good varnish remover, one of the modern sort, free from alkali. This is painted over the surface, and, after a short time, removed with a scraper. The last of the varnish remover is taken off by a rag wet with turpentine or benzine, care being taken that there is no fire of any sort in the room or an adjoining room. This will not only take off the old varnish, but the old filler also; and the floor must be treated like a new floor. Any stains on the floor may be treated with a hot solution of oxalic acid, one part to ten of water; when the stains disappear, wash well with clear water; let the floor dry a day; sandpaper; and it is ready for varnishing again. This treatment of removing old paint or varnish by a liquid varnish remover is applicable to all varnished or painted work. The outside of a house could have the old paint taken off in this same way, but burning off is cheaper and quicker. These varnish removers are mixtures of benzole, acetone, alcohol, and other liquids, and the best of them are patented.

Varnish and Shellac Summary. Varnish should never be applied with anything but a clean brush. First, pour out about half a cup of varnish. Next, fill the brush full of this varnish and scrape it out

over the edge of another cup. Repeat the operation, using up the half cup of varnish, and the brush will be in good shape.

A stiff bristle brush is suitable for use only on floors and should not be used for heavier bodied furniture varnish, as brush marks would show. A soft fitch or Russian oxhair brush is the best suited for furniture and woodwork. Use a two-inch chisel or oval brush for large surfaces, such as table tops, door panels, baseboards, etc. An inch brush is very convenient to have ready for small mouldings, corners, etc. Remember that for all but the finishing varnish coats, thin applications of varnish are far superior to heavy coats.

Sandpaper each coat except the last, using No. 00 sandpaper. Sand the entire surface, rubbing just enough to remove the gloss of the varnish to produce a smooth, even surface for the following coat. Rub with the grain of the wood. The scratches will show if you rub across the grain.

Varnishing any surface requires good workmanship. This can easily be accomplished by *brushing* the varnish on the surface, *spreading* the varnish out in an even film, and *removing excess* varnish. Apply the brush freely and quickly and brush with the grain of the wood. Lay off the surface by brushing across the grain of the wood. Do this without refilling the brush, as this operation is intended to spread the varnish over any spots missed the first time and to produce an even film.

Wipe the brush on the edge of the cup to remove most of the varnish and then "straighten out" the surface by brushing with the grain of the wood, wiping the brush occasionally against the edge of the varnish cup to keep it fairly dry. When "laying off" and "straightening out" a panel, table top, or any broad surface, always run the brush strokes to the edge without stopping.

Staining. Stains are purchased in cans or bottles ready for use. There are three typical kinds, namely, water or acid stains, spirit stains, and oil or pigment stains. These are for use on wood. Each has its particular use.

Acid stains provide the most permanent wood dyes one can obtain. However, if wood thus stained is painted over with ordinary paint, the stain will bleed through. The wood should be sandpapered thoroughly before applying the stain. Apply the stain by using a soft cloth. To obtain lighter stains, dilute with water. Always

test on a piece of scrap wood. The stained surfaces should be allowed to dry over night and then sandpapered by using No. 00 sandpaper, or finer, because the water in the stain raises the grain a little. Spirit stains do not raise the grain of the wood and can be painted over if desired. Oil stains are satisfactory for hard woods and especially for soft woods. Oil stains should be brushed freely on the wood, allowed to stand a few minutes, and then wiped off with a soft cloth. The standing time determines the depth of color. All stains require a sealing coat of white shellac. Sometimes a foundation of equal parts of raw linseed oil and turpentine is applied to wood before staining.

Staining Refinished Wood. The wood should be cleaned and all previous paint or varnish removed by using some prepared remover and soap and water. If bleaching is required, use a hot saturated oxalic acid solution. If stain was originally used, it should be washed out as much as possible. If some stain remains in the wood, this must be considered in re-staining. That is, if the wood was originally stained mahogany, or any dark color, it should be stained the same color again. Spirit stains are best because of their penetrating qualities. Sandpaper or scrape the floor before refinishing as with new wood.

Filling. Open-grained woods such as oak, walnut, chestnut and mahogany require the use of a paste filler to fill the pores of the wood and level the surface for the application of the finishing coats. The closed-grained woods such as maple, birch, pine, etc., do not require a filler. An exception may be made of birch. While birch is really classed as a close-grained wood, the use of a paste filler in connection with red and brown mahogany and walnut effects, helps to bring out the beauty and character of the grain effectively.

The fillers most commonly used are divided into two classes—liquid and paste. Liquid fillers are usually quick drying. They are brushed on to the wood and allowed to dry. A liquid filler does not really fill the wood, but rather coats it over with a shell of pigment and varnish or shellac. The paste filler is recommended by most users.

When applying a filler, thin it to a creamy consistency with benzine and apply to the entire surface. When the material starts to set, indicated by a partial flattening out, wipe off by rubbing with

a soft cloth, first across the grain; then wipe clean. Allow to dry for 48 hours before applying varnish.

Paste fillers may be obtained in many cases having the quality of coloring as well as filling. Other fillers do not change the color of the wood.

Summary. If plain stain is used, the wood is first stained and then filled. In other words, fillers always follow the stain. Paste fillers may have coloring added to them in which case the wood is colored and filled in one operation. Fillers do not require sandpapering.

CHAPTER V

EXTERIOR PAINTING

Exterior painting and the preparation of the various surfaces, plus other items necessary on a paint job, are not at all intricate to do if a few simple rules and standard practices are followed carefully. In this chapter some of the rules are explained, especially those applying to the preparation of new and old surfaces.

Siding, Trim, etc. On new residences or other buildings, the painting of siding, trim, etc., should not be started until all have been nailed firmly into place. If there is going to be any changing of the surface, the priming should be held up until all changes have been accomplished, because once the priming coat has been applied the surfaces cannot be moved a fraction of an inch without leaving some small space without the proper protection of the priming coat. Even a fraction of an inch over a long stretch on siding, for example, left without the protection of a priming coat would result in that portion of the siding having a tendency to decay or deteriorate more rapidly than the other parts which have been properly covered. This matter of putting the priming coat over the entire surface is important and should be given due consideration.

The painter should see that all new exterior wood is free from splinters, grease spots, dirt, etc. Where grease spots do occur, good sandpapering will take them off generally. The priming coat should not be applied on new wood if the wood is wet or even damp. This means that if a rain storm has thoroughly wet the siding or trim, priming should not be put on until such time as the wood has had an opportunity to dry thoroughly. In this same connection, no priming should be applied early in the morning when dew or other moisture is still on the wood. The temperature, also, has to be considered. It is best not to paint any woodwork on the outside if the temperature is much below 50 degrees. Also, in painting exterior wood during the day it is best to work as much as possible in the shade so the direct rays of the sun will not shine on the paint immediately after it is applied.

If moisture or grease or even heavy dirt spots are painted over,

they are almost sure to cause trouble later on and shorten the life or the protectiveness of the paint film.

The priming coat should be brushed with hard strokes of the brush so as to thoroughly brush the priming paint into the pores of the wood. The painter should scrutinize the work to make sure that he has covered the entire surface. The coating need not be thick. A medium thick coating well spread and well brushed and made to cover the surface entirely is much better than a thick coating applied carelessly. Also, a thick coating is apt to run which may cause such troubles as are explained in Chapter VI.

New outside wood should receive generally three coats of paint. The first coat, of course, is the priming coat. The priming coat should be allowed ample time to dry and harden before the second coat is applied. If the priming coat has not had an opportunity to thoroughly dry and harden, it will remain soft under the second coat and the same thing is true relative to the second coat under the third coat. For best results, the paint should be allowed ample time to not only dry but harden, and therefore, form the really protective film desired. A minimum of two or three days between coats is recommended and a week would be even better. However, waiting a week between coats draws out the length of time necessary to complete the job and this usually is not done.

When the priming coat has been applied and is dry, the surface should be examined for defects. For example, knots and sappy streaks should be shellacked. The shellac should be put on thin and well brushed. If the painter notices that the lumber is knotty, he can use less oil and more turpentine than called for in such formulas as given in Chapter II or present in already prepared paints. All nail holes can be filled with a good grade of putty. In applying putty to nail holes, the putty should be pressed in the holes firmly and then scraped off the top with a scraper. Unless the putty is forced into holes and cracks, it is likely to come out within a few months.

The second and third coats are applied much like the priming coat although the brushing need not be as hard. If the third coat is to be tinted, it is a good plan to tint the second coat a little lighter than the third coat. This helps the painter to be sure to cover the entire surface without leaving any so-called "holidays" without benefit of the second coat. Then the third coat being the final color and

a little darker than the second coat can be applied without chance of "holidays" occurring.

Repainted Woodwork. In cases where outside woodwork has been painted previously, the surface should be examined carefully, not only in one place but in several places, to ascertain its average condition. If the old paint is in fairly good condition, it can be used as a priming coat and then only the ordinary second and third coats applied to the surface.

There are a number of defects that might occur in exterior painting, especially paint applied to siding. If blisters occur in frequent areas, it is a sign that the paint is not in good condition. If possible it should be burned off with a blow torch. The blow torch is applied to the paint and as the paint softens it is scraped off with a putty knife. The putty knife in this instance should be used in a forward motion following up the flame of the torch. Care, of course, must be exercised not to burn the wood, although a few dark spots here and there caused by the flame are not objectionable.

If the paint does not contain many blisters or does not appear loose, then it should be sandpapered to remove blisters that occur only here and there. Sometimes scrapers are used on exterior paints similar to those used by carpenters in scraping finished flooring.

If all or a large portion of the original paint is removed, then a priming coat is applied exactly as in the case of new wood. If it has been found necessary only to remove the paint in occasional spots, a priming coat can be applied to these small areas, and when dried and hardened the second coat of paint is applied.

If the original or old paint is a darker color than the new paint to be applied, some special consideration must be given to insure the new paint covering the old paint completely. In such cases it is advisable to tint the first coat of the new paint a shade lighter than the final coat. If the final coat is to be a light color, then it may be necessary to apply two and possibly three coats of what we ordinarily think of as second coat paint. A small amount of lampblack applied to the first or priming coat is used often to make a satisfactory covering.

If the old paint is dry, it may be necessary to alter the paint formula or the ready to use mixture. Reference can be made to the mixing explanations given in Chapter I relative to such cases.

Outside Wood Floors. The floors on outside porches, entry ways, summer kitchens, etc., require the usual minimum of three coats if it is new wood, and a minimum of two coats if the wood or surface has been painted. The surfaces of horizontal wood to be painted, such as floors, should be given special consideration as to cleanliness. Flooring is more apt to become dirty or have other imperfections because of the constant walking over it. If the surface is rough in one or more places, these places should be thoroughly sandpapered using first a rather rough sandpaper and finishing off with a No. 00 sandpaper.

The three coats of paint for new flooring are applied in exactly the same manner as for other exterior wood and carry the same considerations relative to application, drying time, weather, moisture, etc.

If a repaint job is being done, the same precautions must be taken for inside woodwork as are taken for outside woodwork. If the paint is old and rough or scaly and thick or gummy, the floor should be cleaned down to the wood by planing, burning, and scraping, or by the use of a good paint remover. Special consideration should be given the use of a paint remover, because if it contains lye or some other strong alkali the surface must be brushed afterward with a strong vinegar solution to neutralize the remaining traces of the remover. Otherwise considerable difficulty will be experienced shortly after paint has been applied. The use of a paint remover is not objectionable and is sometimes speedier than the other methods, but it should not be forgotten that the surface must be neutralized after its application.

In many instances porches are built so that they are a few inches to two or three feet above the ground. In many cases the area underneath the porch floor between it and the ground is poorly ventilated. The result is that the air in this space is damp more or less and for this reason the underside of the porch floor requires some paint protection as well as the top side. A good paint formula to use for such protection is No. 22 as given in Chapter II.

During the time new porch floors, etc., are being put down the tongues and grooves while still in bundles should be painted with a priming coat, if possible. It takes but a few moments for a painter to apply this priming coat which preserves the life of the flooring longer than it would otherwise last. If the paint is put on fairly

thick and well distributed, not more than one coat is necessary for the under side of porch floors.

Shingles on Side Walls. In Chapter II stain was discussed relative for usage on shingles and side walls. In many cases ready prepared stains are used, some of which are spirits, chemicals, and dyes. In some instances shingles are dipped into the stain mixture and allowed to dry before being nailed to the side walls. This, however, gives both sides of the shingles the stain application which is not exactly necessary insofar as protection or appearance is concerned. Brushing is the method used generally and the stain is applied in much the same manner as is the paint.

The shingles should be dusted off to see that no dirt is adhering to them before the stain is applied. Shingles may, also, be given three coats of paint if any decided luster is desirable or if the color combinations obtainable by the use of oil paints are desired. In this connection a priming coat can be applied made up of such typical paints as given in Formula (1) of Chapter II. When this priming coat has become dry and hard, a second coat can be applied using paint made up of a formula as follows:

White Lead—100 lbs.
Linseed Oil—2 gals.
Turpentine—¾ gals.
Liquid Drier—1 pt.

This formula makes approximately 6 gallons of paint that has a covering of 600 square feet per gallon. For the third coat a paint may be applied, as given in Formula (3) of Chapter II.

Of course, these formulas do not include any coloring. If shading or coloring is desirable, it can be mixed into the paint, as explained in Chapter III.

Staining Roof Shingles and Rough Siding. Roof shingles and rough siding are generally stained by the dye method rather than by the painting method. The types of roof shingles which can be stained are limited to the wood shingles, such as the ordinary cedar shingles commonly used in rural districts. The building codes of practically all cities and towns prohibit the use of wooden shingles on roofs.

Rough siding is that type of siding which has not been planed. It is stained shades of brown, red, and green and is used generally in

conjunction with brick, or stucco. In most instances the siding is stained before being put into place by the carpenters.

The dyes or stains used for this type of work have been explained in Chapter III. In applying the dye, a brush can be used but care must be taken not to pour more of the stain over one part of the surface than another. Therefore, in applying the stain, the brushing should be done rapidly making sure that the surface has an even coating of stain.

If stains are used once on wood surfaces, it is not possible to paint them unless some sealing coats, such as shellac or aluminum, are applied over the previously stained surface. If this is not done, the stain will bleed through the new paint and cause it to be streaked and spotted.

Brick, Stucco, Concrete, and Stone Painting. Any of these surfaces may be painted, as a means of preserving them and decorating them. However, they should be at least six months old before any paint is applied to them. During this six months' period the surface has a chance to dry out thoroughly and age. Sometimes, due to construction schedules and requirements, it is not possible to wait six months for the surfaces to age naturally. They are therefore aged artificially. This is done by using a solution of 2 pounds of zinc sulphate with a gallon of water. Such a mixture can be painted on the surfaces with a brush. It is essential that every square inch of the surface receive this treatment or else the final painting will show bad results within a short time.

Stuccos sometime contain magnesite in which case they should not be painted with an oil paint.

If it is necessary that concrete surfaces be painted as part of the construction schedule, the masonry contractor should be cautioned if economic conditions permit the use of matched boards tongued and grooved to make up the forms. In this case the inside of the forms should be sanded and oiled. Thus when the concrete is poured into these forms, it will be uniform and not have the joint marks between boards and the graining of the board present in its surface. Another way of making a better concrete surface is to go over it with a steel trowel immediately after the forms have been removed so as to smooth it down as much as possible.

Before painting any of the surfaces, they should be thoroughly

brushed with a very stiff brush so as to remove all dirt and dislodge any small particles of cement, mortar, etc.

If old stone or brick surfaces are being painted or repainted, the mortar joints should be examined to see that they are tight. If it is found that the mortar is loose, it should be scraped out and then carefully replaced.

Dry weather is essential for the painting of stone and brick. Therefore, after a rain storm or under any other condition where the stone or brick surfaces have been wet, time should be allowed for them to thoroughly dry. Painting is not advised during weather much below 50 degrees. Care should be taken to note that surfaces are not frost covered when painting is started. It is recommended also, that as far as possible the painting of these masonry surfaces be done on the shady side of the building in summer and on the sunny side during the winter.

Typical paint for use on masonry surfaces is shown in the formulas given in Chapter II. Paint, of much the same nature and highly recommended for masonry surfaces, can be purchased in cans ready to use. Many manufacturers are preparing paint especially formulated for use on masonry surfaces. They are somewhat similar to the formulas given in Chapter II.

Regular paint is applied to all these surfaces without any difficulty, with the exception of brick. However, if the red color usually used on brick is desired, a good brick red finish can be obtained by mixing 1 gallon of Venetian red with about 3 quarts of lead mixing oil or 2 quarts of turpentine. This can be applied easily and the only consideration, other than brushing evenly, is to see that all areas are covered thoroughly.

On new concrete or even on old concrete surfaces after the priming coat has been applied, it is advisable to go over the surface carefully and fill up any small holes or irregularities with plaster of Paris. Other substances however can be used equally as well. In cases where holes are filled up in this manner, it is a good plan to shellac or put a sizing of some sort over the new filler. This is done before the second coat is applied.

Old masonry surfaces that have been previously painted with oil paint, do not require any special preparation or priming other than to be thoroughly clean, making sure that no blisters or other un-

desirable features are present. The original paint if in good condition can be used as the priming coat and then the second and third coats applied in the usual manner. Wherever blisters or undesirable paint spots have been removed from an original paint job, these places should have a priming coat applied to them before putting on the second coat.

Painting Concrete Floors. Typical paint such as is applied to concrete floors is made up as given in Formulas (6) and (7) in Chapter II. Prepared paints can be purchased and used with the same desirable results.

Concrete floors, of course, should be thoroughly cleaned, removing all grease spots and small particles of masonry material. They should then be given a priming coat by using a paint similar to Formula (6). This priming coat should be given time to dry and harden. Then if a particularly good result is desired all small holes and other irregular places can be filled with putty unless, of course, the holes are too big. In this case they should be filled with a mixture of cement and water prior to the time of painting. The second coat is applied in much the same way as for wood. Enamel finishes or final coats can be applied to concrete similar as to other surfaces.

If original paint on concrete floors is dark and especially if it is darker than the contemplated new paint, then the priming coat (if used) or the second coat should be tinted somewhat as explained previously to help cover the dark color. A second application of second coating might be necessary to assure good coverage before the application of the third coat. This is especially true where enamel is to be used as a third or fourth coat.

Paint for concrete floors should be mixed so that it has an even consistency. In applying the paint it should be brushed uniformly. It is always better to apply one or two extra thin coats than to attempt to put on one thick coat. A thick coat is undesirable because there is a tendency for it to fail to harden underneath with the result that the paint is soft or spongy long after the paint job has been completed. If it is spongy or soft it then becomes easily dented and in a short time looks undesirable.

Four or five days or even a week must be allowed for drying between coats especially on masonry material, such as floors. In many instances in painting concrete floors it is desirable to decorate

them in one manner or another. This can be accomplished easily in one way by using stencils which are explained in an advanced chapter. If only lines are required around the edge of the floor as a means of decoration, this can be done easily by the use of what is called painter's tape or Scot tape. This tape is adhesive on one side which makes it stick without having to wet it. It can also be pulled up easily without disturbing the paint underneath it. After two of these strips of tape are pasted down, with a space of $\frac{1}{16}$ of an inch or over between them, a contrasting color can be painted between the spaces. When dry, the strips are pulled up. Such a practice is simple to accomplish and assures good straight lines for line work.

Screens. The highest grade of screens are made from copper screening. The painter should always keep in mind that copper does not require painting and that no paint should be used on it. The wood frames, however, do need painting.

If the screening used is the ordinary black screening and not of copper, it should be painted one coat. In painting the screening the screen should be in a horizontal position supported by wooden horses. In this position the screen can be painted on both sides without the paint running on the mesh of the screen. When applying paint to screens, the brush should have only a little paint in it to start the job. The painting is carried on by more or less rubbing the screening with the brush rather than by using the long strokes necessary in ordinary painting work. It is essential that the entire screen receive paint and for this reason it is a good policy to paint on both sides.

New wood in screens needs three coats of paint as explained for outside woodwork. The three coats are applied in the same manner as explained for exterior woodwork. It is often desirable to have colored paints on screens, in which case the ordinary white lead and oil paint can be tinted any desired color by the addition of color in oil.

Screens which have been painted with the ordinary three coat job should be painted with one coat once a year. Both the woodwork and the ordinary screening should receive paint.

Sometimes screens are made from galvanized screening. In this case no paint is necessary on the screening for the first two or three years.

Blinds. Blinds or shutters as they are sometimes called are gen-

erally made of soft wood and receive about the same paint treatment as exterior siding or trim. They are, however, generally painted in a contrasting color to the siding, usually green, which seems to be the traditional color for blinds.

It is advisable to paint the blinds before they are hung into position. The first coat can be white paint of the ordinary priming formula. In the second coat it might be desirable to tint the paint near the shade of the final coat and then, of course, the final coat will have the desired shading. All of the stipulations relative to the exterior wood should be followed in the painting of blinds.

Gutters and Downspouts. Gutters for first-class residences and other buildings are often of copper in which case no painting is required. The same holds true for downspouts.

Where ordinary galvanized metal is used for gutters, flashing, and downspouts, painting is not only desirable but absolutely necessary if these parts are to last for more than two or three years.

The inside areas of gutters or the areas carrying the water are sometimes painted with a good red lead paint. The exterior edges if they are visible can be painted with the same paint used for the exterior wood parts or a coating of red lead paint can be applied as the priming coat in cases where the final color is to be dark. Otherwise, if a red lead primer is used, it may take more than the ordinary second and third coats to cover it completely.

Downspouts can be painted the same color as the surfacing of siding or they can be given a color similar to any trim colors used. In most cases, the downspouts are painted the same color as the color of the surface to which they are directly adjacent so as to make them less conspicuous. Flashing if not visible can be given one or two coats of good red lead paint to preserve it.

Miscellaneous Items. In city apartment buildings, which are generally of masonry construction, the windows for the most part are of wood. The sash and such parts of the frame and sill which are exposed to the exterior should be painted three coats, using paint similar to that used on ordinary exterior woods. Some consideration should be given the windows on the sides exposed to the summer sun, as explained in Chapter III.

The sash and other parts of the frame can either be painted all in one color which contrasts nicely with the color of the brick work

or they can be painted in two colors one contrasting the other and both in contrast with the color of the brick work. The shades most generally used are cream, white, and light green. After the original three coat work, it is an excellent idea to give the windows a single coat about once every three years.

Before applying the single coat, the woodwork should be thoroughly brushed with a stiff brush and should be scraped to remove all blisters, chalking, and other irregularities. In some instances, if too much of the paint has to be removed in this manner, then a priming coat should be applied for the finish coat.

After windows are painted, they should be opened slightly from top and bottom and kept in that position until the paint is dry, otherwise they are apt to stick which makes opening of the windows almost impossible after the paint has thoroughly dried.

When windows are being repainted, the condition of the putty should be noted carefully. If it is loose or has fallen off in one or more places, it should be replaced because the window glass is very apt to rattle, and during cold weather there is a large amount of infiltration of cold air.

Canvas decks such as are used in many instances for small roofs over entry ways, entrances, and sun parlors on residential constructions should be painted with white lead. They should be given two or three coats so as to make the canvas entirely waterproof.

Where ornamental fences of wood or ornamental iron are used they, too, should be given careful original painting and periodic repainting to be kept not only in good condition but to better serve their decorative purpose. Wood fences of the ordinary three coat work, as recommended for exterior woods, can be used. Some fences may be painted in the same general color as the residence or they may be painted in some light contrasting color. In all events a fence should not be given a dark, heavy color because it makes it stand out too prominently. White is sometimes used but that is the only solid color advisable. Light green, tan, and cream colors are recommended.

Garages are in most cases painted in the same color scheme as the residence which they serve. If any roof staining is done on the garage it should be the same as on the residence.

Fence posts, clothes poles, and other such items of wood that

are extended in the ground should be painted with a creosote paint on that portion which is to be underground. This prevents decay and preserves the wood for many years.

If lattice work or trellis work is to be used in the construction of a residence for ornamental purposes, it is an excellent idea to paint the slats used in its construction before they are nailed into place. To paint them after they are nailed into place is a long and tedious operation from the labor standpoint and difficult from the painting standpoint. Therefore, when the slats are first delivered to the job, they should be primed and at least given the second coat before being turned over to the carpenters for erection.

In cases where window frames and sash are delivered to the job, either in bundles or already assembled, they should be given immediately a priming coat either of linseed oil or the regular priming coat specified for interior woodwork.

Barns and other farm buildings, as well as residences, should be painted as soon after construction is completed as possible, because as explained previously the longer wood is exposed to the weather without protection the more chance decay has of gaining a foothold in the wood.

CHAPTER VI

INTERIOR PAINTING

Painting Woodwork. When interior woodwork is to be painted, it is recommended in most instances that it be given the regular three coat paint job the same as for outside wood with some few added suggestions.

The painting of interior woodwork usually starts just as soon as the carpenters have completed its installation. The surface should be prepared by sanding any rough spots and insuring that no sharp edges are present. The surface should be examined for grease or dirt or other impurities which might affect the paint coating.

A priming coat should be applied with all the precautions previously explained relative to application, full coverage, etc. Priming coats for interior woods are typically illustrated by Formula (11) of Chapter II. Mixed on the job or ready mixed paint can be used equally as well. The priming coat can be applied in its white color without the addition of any tinting.

For exceptionally good work the priming coat should be allowed to dry the period specified in previous explanations and then sanded lightly to insure the surface being smooth. All nail holes, possible cracks, etc., should be filled with putty.

The application of paint to interior woodwork should not be done if the temperature is much below 50 degrees or if the wood is damp. The wood should be in perfectly dry condition and at temperatures from 50 degrees upward.

The second coat can be typically illustrated by Formula (12) of Chapter II. Here again either mixed on the job or prepared paint can be used equally as well. Any knots or sappy places can be given a thin coating of shellac to insure a perfect exterior finish. The third or final coat is applied after the second coat has dried thoroughly. A typical third coat can be illustrated by Formula (13) in Chapter II.

Repainting Interior Woodwork. Before repainting interior woodwork, a very careful scrutiny of the surfaces should be made to

ascertain the condition of the paint and the surfaces in general. If it is found that the paint is in good condition with no other defects other than being faded, darkened, or naturally dirty from the effects of time, then there is no reason why the original paint cannot serve as the priming coat. However, if the paint shows blisters, roughness, streaks, or looseness, it should be at least removed in spots where these defects occur or, better yet, all of it removed by using a paint remover. Interior woodwork should be absolutely free from defects of any kind insofar as its painting is concerned, because a great deal of the beauty of room interiors is brought out by the finish of the woodwork. Poorly finished woodwork means unsightly interiors.

It should be pointed out here that woodwork which has been previously stained should be given a very careful treatment if paint is to be applied. It would be a good idea to use some remover in an attempt to remove as much of the old stain as possible. Then before putting on a priming coat, shellac or aluminum paint should be used to seal the firmness of the dye. Otherwise the dye is almost certain to bleed through and mar the surface of the new paint.

Whether paint is removed or not the surfaces should be sanded to remove any of the paint that might have become chalky and to make the surface as smooth as possible for the new paint.

The priming coat is necessary and the second and third coats can be used, as previously explained. Puttying should be carried on with the same care as for new wood.

If the original paint is of a darker color than the new paint, it might be necessary to tint the undercoat with lampblack or to use a light shade of the final color to completely cover the original paint. Also, as previously explained for other purposes, it is a good idea to have the priming coat white, and then the second coat tinted a little so as to make it easier for the painter to avoid leaving "holidays." Also, darkening or tinting the undercoat a little adds to the covering ability and gives a better appearance to the final coat. And, if the final coat is a little darker than the second coat the same assurance can be had relative to "holidays."

Enameling Interior Woodwork. Where interior woodwork is to be enameled the preparation of the surfaces and the priming and second coat are exactly the same as explained previously for other woodwork. The exception to this rule might be that where enameling

is to be done more sanding can be carried on to better prepare the surface for the highly glossy and smooth enamel surface.

Enameling undercoating is carried on in two general ways. In the first place, the priming coat and second coat are applied, as previously explained. Then additional undercoats, generally two in number, may be applied. The first additional undercoat can be of the same material as the regular second coat. The second additional undercoat can be mixed half and half with enamel. Then the final coat can be pure enamel. The second way is to use the regular priming and second coat and put the enamel on as a third coat. This second method is satisfactory, although it does not give the desirable surface that the first method does. The only exception to this second rule is that if the second coat does not completely cover the surface smoothly then an additional undercoat could be applied of the same paint. Where the first method is used sanding should be carried on between coats using No. 00 sandpaper.

If the enamel used is to be tinted or if the enamel purchased is already colored, then it would be a good idea to tint one or two of the undercoats to a shade somewhat lighter than desired for the final coat. This, as explained before, makes a better final appearance.

When previously painted woodwork is to be enameled, the surface should be carefully scrutinized as explained previously. If the enamel has been used previously and is in good condition without any defects, then it is possible that one coat of enamel as it comes from the can would satisfactorily cover and give a pleasing appearance. If the old paint was ordinary flat or gloss paint and not enamel, then it would generally be best to apply one undercoat before applying the enamel.

Enamel surfaces to look their best should be smooth. Precaution should be taken in the use of shellac over knots, etc., to prevent any possibility of the surface being marred some time after the painting has been completed.

Enameling woodwork in kitchens is not objectionable if good judgment is used in the selection of color. A white enamel in kitchens is naturally attractive, especially if it is kept clean. However, due to cooking and oven heat there is a possibility that the white enamel will have a tendency to darken in some instances and become an off white shade that will not be desirable. Therefore, kitchens are often

enameled with a color that is somewhere between a light tan and a white which eliminates the possibility of such discoloration.

Washing Painted Surfaces. Any painted or enameled surface naturally becomes somewhat dirty within a few months' time especially in living quarters heated by steam and hot air. Also, the dirty condition is brought about by moisture conditions and other things quite out of anyone's control. Light colored paint or enameling can be satisfactorily washed if care is used. It is possible to purchase washing powders prepared especially for the use of painters for washing painted and enameled surfaces. If these powders are used in small quantities in large amounts of water, as is directed on the container in which they are purchased, it is not likely that the paint surface will be harmed. Washing the surfaces can be done with a soft sponge taking care not to rub over the same surface very hard or any more than is absolutely necessary to remove the dirt. Washing of enameled surfaces is a little easier than ordinary painted surfaces, but if the application of soap and water is too severe much of the gloss is likely to disappear.

Ordinary soaps, such as ivory, can also be used on woodwork, but it is strongly recommended that no common laundry soaps be used because they are sure to ruin the surface.

Staining. The interior woodwork, especially the trim, makes up a sizeable part of the total cost of any residence or other building. Where hardwoods are used for trim purposes, an even greater amount is involved because they are expensive as well as attractive. The cheaper woods, such as pine, birch, or gumwood can be made to look exceptionally well with proper thought and care in their finishing. As previously explained, the woodwork of an interior has a great deal to do with the desirability of that interior for living or other purposes. Therefore, considerable thought should be given to its finishing.

In the first place, carpenters should not be allowed to install woodwork if the plaster is not thoroughly dry. Also, if trimming out, as it is called, is necessary during very wet weather some form of artificial heat should be provided to keep the plaster and the wood itself as dry as possible. For best results, especially where the higher priced woods are used as trim, the back of the wood or in other words the part of the wood nailed up against the wall should be

painted with one coat of good linseed oil paint. This prevents any present or future moisture from entering the trim and causing it to warp or have any other ill effects. The painter should be ready to work on the woodwork just as soon as the carpenter has completed its installation.

Oak Trim. Oak is what is called an open-grained wood. This means that there are open spaces or pores of varying size between the fibers of the wood. When treated properly, it can be made to look beautiful. Such wood requires that the pores be filled where a varnish finish is desired. A paste filler is recommended which fills the pores and levels the surface preparatory to varnishing. If the filler is omitted, a bumpy effect results due to the varnish sinking into the open pores.

To bring out the grain in oak either a dark or light colored filler may be used. The surface of the wood can be brushed with a stiff brush to thoroughly open all the pores before the application of the filler. It is not recommended that mahogany or other effects be attempted on oak because the grain of oak is characteristic. Attempting to imitate some other surface on it does not turn out well. Oak in itself is beautiful and if properly treated it requires no other effects.

Many types of finishes are possible on such wood as oak, having open grains. For example, a very popular finish, called silver gray, is produced by using a filler composed of three parts of white lead and two parts of fine silica, the measuring to be done by weight. This mixture can be reduced to thin paint by adding equal amounts of turpentine and Coach Japan. In applying this mixture, a convenient area should be covered and allowed to set but not harden. Before hardening takes place the area should be vigorously rubbed with a piece of hard felt. This rubbing process forces all the filler into the grain and removes any excess. The filler mixture may be colored by adding a small amount of Prussian blue or lampblack, for example, and the finish can be topped off by waxing.

Pine Trim. Pine is frequently used as an interior trim and although not having the beauty of grain that one finds in oak, it can nevertheless be finished up so as to make a satisfactory trim. White pine when used as woodwork is usually painted or enameled. Southern pine can be nicely finished by using most of the possible

stain effects, except natural finish and silver gray. However, a natural like finish can be had if the wood is not stained, because of its natural light yellow color. This same natural light yellow color prevents the effective use of silver gray. Naturally, pine does not require a filler because it is not an open-grained wood.

Walnut. Walnut is not often used as trim because of the expense involved, but it can be made into trim with beautiful results. Walnut because of its dark-toned color may be finished with good effects in its natural color or stained as desired. It is an open-grained wood and requires the use of a paste filler for a full varnish finish. Some desirable effects may be produced with walnut by using light colored fillers in place of dark fillers.

Birch. Birch is used extensively as an interior trim and it can be made to take a handsome finish. It has a fine silky grain which finishes well and yet the wood itself is hard and does not dent or bruise readily. Birch takes enamel finishes better than most woods and a beautiful effect may be easily had.

Staining of birch is common and desirable effects may be obtained by using almost any stain effect. Finishing birch in its natural color is also desirable and is used to a great extent, especially in kitchens.

Although birch is classed as a close-grained wood it can with profit be filled because the filler brings out more effectively the beauty of the wood.

Gumwood Trim. This wood is probably used more than any other wood for trim. This wood takes paint readily because of its even texture. Desirable enamel surfaces can be obtained. The wood is, also, stained and finished in various effects, which also form attractive trim on the apparent side.

Interior Doors. Just as soon as the carpenter has finished hanging the door and has nailed the stops, etc., into their proper places the painter can start his work. The surface of the door should be carefully examined before any application of stain is made because any water spots or grease will show a defect through the stain. Water spots, grease, and other dirty spots can be sanded down satisfactorily. The stain should be applied evenly and if necessary with a dry brush, especially in the case of oil stain because it does not penetrate as an acid stain would. The term dry brush means that the

brush should not have much of the stain in it at one time. The brush should be applied vigorously to the surface being stained. The type of wood of which the inside door is made determines whether or not it requires filling. After the stain has dried then a coat of shellac is applied, and when this has had time to dry the varnish is put on, using one or two coats, as is necessary.

Exterior doors may be finished in somewhat the same manner with the exception that spar or exterior varnish should be used on them.

Natural Finishes. In creating what are called natural finishes on woods such as birch or oak the process is really simple and consists only of applying a filler which has been darkened a little and omitting the stain. After filling, the surfaces may be shellacked and then varnished or varnished directly. Or, if varnish is not desired then waxing can be done, although in most instances the use of varnish is recommended.

Painting over Stain. As previously indicated it is not possible to paint directly over a previously stained surface unless the stain happens to be of a non-chemical type which would not have a tendency to bleed through the new paint. If it is desired to paint or enamel previously stained surfaces and if it is not known just what type of stain was applied, it is easy to make a test on a small surface of the woodwork by simply applying a coat of first or second coat paint to it; and then a little later adding another coat on top of that and then waiting to see whether the stain has any affect on the paint. This, however, requires some time and it is naturally better if it is known what type of stain is on the wall.

Rather than take any chances however a coat of shellac or aluminum paint can be applied directly over the old surfaces, and this will work out satisfactorily if some varnish remover or other type of remover is applied to the original stained surface and as much of the stain as possible washed off. Specific directions relative to the use of stains and removers have been given previously in the text.

If a stain has been removed, it can then be coated over with shellac or aluminum paint. If it is known definitely that a stain does not have a background that might bleed through paint, then to paint or enamel over it, it is required to put at least three coats on. The

first two coats can be, for example, the priming coat and the second coat previously explained for interior wood surfaces. Then if that covers amply well the final coat or enamel can be put on as the third coat. If the first two coats do not cover well enough then either a third undercoating can be applied or the third coat can consist of half second coat paint and half enamel and then the fourth coat consist of all enamel.

Painting Floors. It is recommended that the painter come on the job as soon as the carpenter has completed laying the floor or as soon as all other operations on the interior have been completed. The longer a new floor is left without protection, the more chances there are of its becoming damaged.

Hardwood floors such as oak, maple, etc., are not generally painted. The types of floors generally receiving paint are of the pine class. A floor to be ready for paint should be well sanded to insure its being smooth so that none of the grain sticks up or any other imperfection in the wood allowed to remain. Then the priming coat can be applied as explained for other woods. A typical example of the type of paint sometimes used for priming coats on wood floors is illustrated by Formula (19), Chapter II. Typical examples of second and third coats for interior wood floors are shown in Formulas (20) and (21).

All of the rules given previously for drying time, etc., apply equally as well to the painting of wood floors.

Repainting Floors. When old floors are to be repainted, the same suggestions relative to the examination of the surface, removing old paint if it is defective, and the use of old paint as a priming coat if it is satisfactory, apply equally as well here as to other interior woods. Because of the continuous hard usage that a floor receives, it sometimes becomes badly marred or pitted and scratched. If painted in this condition, it is not likely that the addition of new paint will cover up these defects. If a floor is to have the best possible appearance, then these defects should be removed. To remove them it is recommended that the paint be taken off entirely by using a paint remover. Then any scratched or pitted places can be scraped or even planed, if necessary, to flatten them out and bring the surface back to its original smoothness.

Staining Hardwood Floors. Where floors are to be varnished

as a finish, the preparation includes removing all dirt, grease, etc. The floors should be scraped thoroughly with a regular carpenter's scraper and then sanded thoroughly. This can all be done in one operation by using a power sander which leaves the floors in excellent condition and ready for a high type finish. When the sanding is complete and all of the dust from the sanding has been thoroughly removed, the floor may be stained to the desired color. If the original color is the color wanted, then no staining is necessary. If the floor is an open-grained hardwood it requires filling. Most painters apply the filler to the floor and then allow the filler to dry 15 minutes to an hour, after which they thoroughly rub across the grain using excelsior, for example. This rubbing across the grain has a tendency to fill all of the open grain or cracks. When the filler is thoroughly dry, the floor can be swept clean and the first coat of varnish applied. Sometimes on new residences, for example, after this first varnish coat has been applied the floor is covered with building paper until all work is completed, after which it is washed and then a second coat and sometimes a third coat of varnish is applied.

Where floors are not in especially good condition, such as older floors or where a cheaper wood has been used for the flooring, one method of finishing consists in applying what is called a varnish stain. This has a tendency to cover up most imperfections and at the same time produces a good varnish finish imitating natural wood.

Some recommendations relative to varnishing the floor are as follows: The first coat can be thinned with turpentine so as to make it penetrate better. Sand the first coat before applying the second coat, and if a third coat is applied the second coat can be sanded before the application of the third coat. Sanding has a tendency to smooth the floor out and at the same time it gives a better surface for the top coat to adhere to. The second and third coats, if a third coat is used, can be varnished as it comes from the can. It is recommended that 48 hours be allowed if possible between coats. If the naturally glossy finish of the varnish is not desired, then a flat finish can be obtained by using pumice on the surface and rubbing it until the finish becomes dull or flat.

Miscellaneous Finishes. Oil finishes are not used to any extent

in residential work although they are used in dormitories, schools, and other public buildings. An oil surface is durable and although it requires frequent going over it proves satisfactory. When applied it naturally darkens the wood somewhat but not too much to be undesirable. For a good floor oil a typical formula is three parts of pure boiled linseed oil to one part of turpentine. When boiled oil cannot be obtained, four parts of raw oil can be used together with one part turpentine and one part drier. These mixtures should be stirred frequently while using and should be applied with a strong and stiff brush. The oil should be rubbed well into the wood and all surplus oil that does not penetrate into the wood should be removed. Cloths or rags used during the oiling of floors should be carefully accounted for at the end of the day because if left wadded they are likely to cause a spontaneous fire.

Wax Finish. This type of finish may be applied equally as well over varnish or shellac. A varnish finish is first applied as previously explained. For a shellac finish simply apply two coats of pure white shellac thinned to the proper brushing consistency allowing each coat to dry hard before the other is put on.

The wax can be applied by hand by gently rubbing the wax with a soft cloth onto the surface of the floor. Wax can be purchased in many varieties either as a paste or as a liquid. Waxed floors require polishing after the wax has had one hour to dry. This polishing can be done by hand with a soft cloth; or a wax brush, which has a heavy weight on it, can be pulled back and forth over the surface. Generally the best results can be obtained by hand.

Care of Floors. A waxed, varnished, or shellacked floor needs careful attention almost daily to keep it looking in the best of condition. There are various styles of dusting mops which contain oil, such as cedar oil, which may be used on the floors daily. This prevents the dust which naturally accumulates on most floors from being ground into the surface.

A waxed floor can be kept in good condition by polishing it a little every day or so. Careful attention should be given not to apply too much wax to the floors because they are apt to become slippery to the point of being dangerous.

Floors need actual washing at intervals, and it is advisable to use some prepared soap made especially for this purpose or use a

mild soap. Laundry soaps and harsh soaps are not recommended under any circumstances. In washing floors the water should be warm but not hot.

A floor that has been painted instead of varnished can also be kept in excellent condition by the use of the special soap mentioned in the above or other mild soap and water. The surfaces should be generally cleaned with soap and warm water and then wiped off with a clean, damp cloth or sponge and polished briskly with another cloth.

Painting Walls and Ceilings. When new plaster is being painted it should be either allowed to age for about six months at least or some artificial aging done. Where it is not desired to allow the plaster to age naturally, it can be aged artificially by treating the surface with a solution made of two pounds of zinc sulphate in one

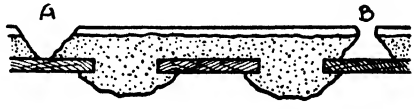


Fig. 5. Showing Two Methods of Enlarging Cracks for Filling
(A) Shows Wrong Method; (B) Shows Correct Method

gallon of water. This can be painted on the surface the same as paint.

Old plaster which has been painted before needs no such consideration and in most cases the original paint can be used as a priming coat.

For new plaster the priming coat is necessary in order to seal the pores and prepare the surface in general for the other coat. A typical paint used for priming plaster is given in Formula (15) in Chapter II. When the priming coat has had ample time to dry the second coat can be applied using a paint such as given in Formula (16) in Chapter II.

The third or finish coat can be one of any desired finish such as flat, semi-gloss, etc. Flat and semi-gloss, cheap paints, are made up by using Formulas (17) and (18) in Chapter II. Ample time should be allowed between coats for the paint to thoroughly dry and harden.

When painting old plaster special care should be given to cracks and other imperfections in the plaster. If the cracks are appreciably wide they should be enlarged, as shown in Fig. 5. The method shown

at (A) is the wrong method of enlarging cracks. The method shown at (B) is the correct method. It can easily be seen that enlarging the crack by this method forms a key to hold in the plaster of Paris or other filler used in the cracks. Fig. 6 shows how the cut-out cracks should be filled to obtain the best possible results. The filler should be forced into the opening with a putty knife or the thumb and then smoothed off with the putty knife.

Over the newly applied plaster of Paris or other filler it is advisable to put on a coating of shellac or sizing of some sort to seal the filler. Small cracks and other small holes can be filled using the same type of filler but they need not necessarily be enlarged unless they are approaching $\frac{1}{16}$" in width.

If the paint being applied to walls or ceilings is to be tinted, the tinting is done as explained in Chapter III. However, the prim-

Fig. 6. Cut-Out Cracks Properly Filled

ing coat can be white, but the second coat should be tinted a little lighter than the color desired for the third coat. The third coat will be the color desired. This eliminates the possibilities of "holidays" in applying a second and third coat and makes for a more attractive finish.

The beauty of a painted wall depends to a large degree upon how the paint is applied, especially the final coat. Flat paint requires careful application because it dries more quickly than gloss paint or enamel. To apply the paint, start at one end of the wall at the top painting a section or stretch about 3 feet wide and work down, not across, the wall. Special care should be taken to keep the edge of the freshly painted surface wet until the entire section of the wall is completed. This is necessary to avoid lapping which occurs if the edge is allowed to set or dry. When the bottom of the wall is reached, start another stretch about the same width, joining it to the first one and working down the wall as before. Now repeat the process until the whole wall is painted, making sure to work fast enough to keep one section from drying before another is joined to it.

Paint should never be applied over old wall paper. If this is done

and the wall paper has to be eventually removed, it cannot be removed without marring the plaster surface. Also, paint applied over old wall paper does not have a desirable surface and makes for an undesirable job in every respect.

Enamel. For enameled side walls or ceilings the first two coats on either new or old plaster are applied, as explained previously. The third coat can be enamel, or a mixture of the second coat and enamel and the fourth coat pure enamel.

Light Diffusion. In general, as explained previously, light can be diffused as it comes in through windows or from artificial sources to better advantage by a flat or semi-gloss finish than by a glossy or enamel finish. Where a surface is too glossy or too reflective, the light is sharply reflected which is not apt to produce the desired diffusion of light. A flat or semi-glossy surface is the most desirable because it has the tendency to diffuse the light in all directions.

Stippling. Where a side wall is to be stippled, the priming coat and second coat are generally necessary for new plaster. If the plaster has been painted, one coat over the old paint is enough for the undercoating work. An additional coat may sometimes be necessary to obtain a solid covering. The final coat is the color desired for the surface. After this is applied and while still wet, it is gone over with a wall stippling brush which is a brush containing wire bristles. The stippling effect is produced simply by striking the wet surface before the paint has set. The ends of the bristles pick up the paint and redistribute it, resulting in a uniform pebbly like surface that eliminates heavy brush marks or small surface blemishes. Stippled surfaces can then be starched to preserve them. A mixture of starch and water is applied with a large brush. It is, of course, transparent and is not visible. However, it keeps the stippled surface clean and then some time later, say in six months or a year, the starch can be washed off and re-applied, which saves repainting and restippling.

Crumpled Roll Finish. To produce this type of finish, select two harmonious colors, light and dark, that differ enough in tone to offer a pleasing contrast. The first coat of paint is tinted to one of these colors, applied, and allowed to dry. Then the finish coat is prepared, brushed on a workable section at a time and rolled, as described below, while still wet. Prepare the finishing coat according to the formulation for any third coat of plaster work. The rolling is done

with a double sheet of newspapers or other absorbent paper crumpled tightly into an elongated wad. Newly printed newspapers should not be used because the printing ink comes off the paper and spoils the appearance of the wall.

Starting at the top left-hand corner of a freshly painted surface and rolling diagonally downward, turn the roll of crumpled paper over and over with the fingers, pressing it firmly against the wall to keep it from slipping. This is illustrated in Fig. 7.

Continue the rolling to the bottom of the wall and repeat for the next strip permitting the end of the roll of paper to just overlap the edges of the previous strip. All missed spaces should be patted with

Fig. 7. Crumpled Roll Finish
Courtesy of National Lead Company

crumpled paper and all blurs touched up and re-rolled while they are still wet.

Sponge Mottle Finish. In this type of finish the colors selected for the ground and mottling coats should differ enough to show the desired amount of contrast. A flat or ground coat properly tinted should first be applied and allowed to dry thoroughly. Prepare this ground coat according to some typical third coat formula given in Chapter II. This same paint can be used for the mottling coat. To proceed with the mottling, a coarse fiber sponge is used. It should be cut in half to make a flat surface. Soak one of the halves in water to soften the fibers and then wring the water out of the sponge thoroughly. To do the mottling, press the flat side of the sponge lightly

in some of the mottling paint previously spread on a board and then tap the wall with it here and there. This is illustrated in Fig. 8. It is necessary to go over the entire surface in this same way but make

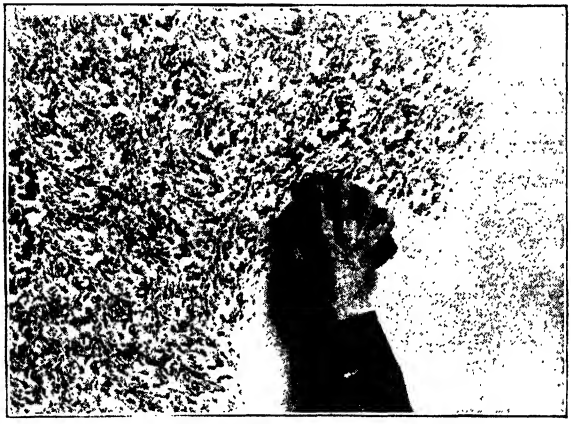


Fig. 8. Sponge Mottled Finish
Courtesy of National Lead Company

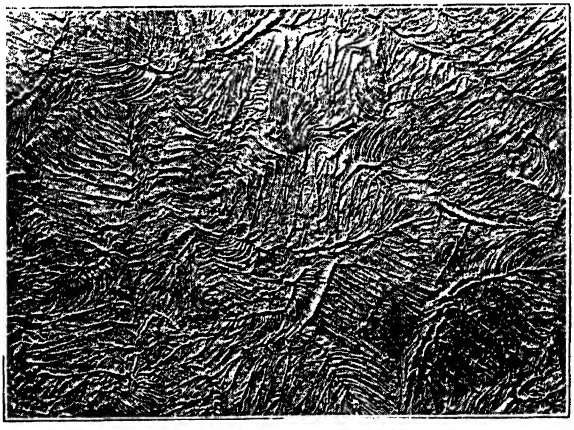


Fig. 9. Vein Relief Finish
Courtesy of National Lead Company

no attempt to follow any designated pattern, as much of the time of the sponge mottle finish will be lost.

Vein Relief. This effect may be produced easily by striking the wet plastic paint sharply over the surface with the flat side of a 4-inch wall brush. This is illustrated in Fig. 9.

There are many other types of finishes which may be applied to wall surfaces equally as well and satisfactorily.

Defects in Painting. Up to this point recommendations have been made relative to the proper procedure for painting and the defects caused by improper procedure have been outlined. The reader is advised to pay particular attention to these recommendations because they explain the difference between good and poorly painted surfaces. There are a few very definite defects which happen in painting work which can be briefly explained as follows:

Checking. The results of checking are illustrated in Fig. 10. Checking occurs in the form of fine splits or ruptures in the paint

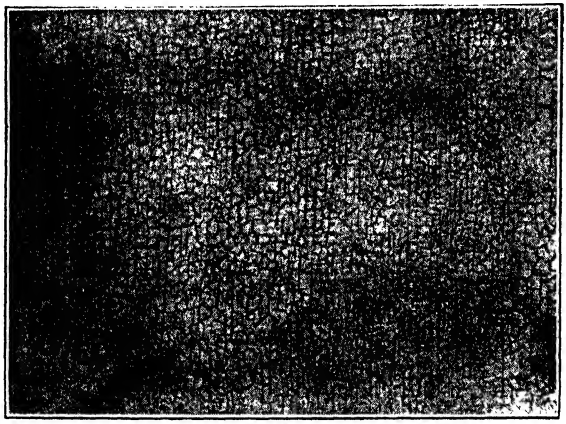


Fig. 10. Illustrating Checking
Courtesy of National Lead Company

which cause the surface to break into innumerable small irregular areas. These occur only in the top coat and do not extend through the surface to the undercoating. Checking is generally caused by the undercoats being too soft at the time the final coat is applied. It can generally be avoided by following the recommendations given throughout the text in allowing ample drying time between the undercoats.

Alligatoring. This defect is somewhat similar to checking although the breaks or cracks in the paint film are much wider and the surface is broken into larger irregular areas, which affects the top coat only. If this defect happens to paint, it naturally mars the surface and makes it unsightly. It also makes any following coat of paint difficult to apply properly, and even after new paint has been applied the surface does not have the proper appearance. Where this defect takes

place, it is sometimes necessary to remove the old paint entirely and apply a new coat of paint to the surface. If the undercoats have not been allowed to dry thoroughly, as with checking, or if too much oil has been used in the paint this defect usually takes place.

Cracking or Scaling. In cracking there is a rupture of the paint film extending from the surface clear down to the wood underneath it. Where such a crack exists it is easy for moisture to get behind the paint film and this in time loosens the paint and the paint scales off as a result. If a paint is used that becomes hard and brittle with age, it cannot follow the natural movement of the wood upon which it is applied and therefore the paint cracks. These cracks occur if improper formulation has taken place in the mixture of the paints or if the wrong kind of paints such as cheap paints have been used.

Blistering and Peeling. It has been recommended repeatedly that no paint be applied to wood if the surface is wet. Blistering is a direct result of applying paint over a wet surface. After the paint has blistered it naturally peels off. It is not an uncommon sight to see exterior painted surfaces with large swollen blisters on them or where these blisters have cracked and peeled off.

When paint is applied over wet surfaces, it does not form the proper adhesion to the wood. If the hot sun shines on this portion of the painted surface, it is quite likely to raise the vapor pressure of the moisture and this again causes blistering. The same process can happen on interiors, especially near radiators or registers.

Spotting. This defect is noticeable by the loss of gloss or by the fading and chalking in spots or other smaller areas. This is caused by absorption of oil from the finishing coat. Absorption takes place when not enough undercoatings have been applied to a surface before the final coat is applied. This text has repeatedly advised the application of at least three coats of paint on most surfaces for this very reason.

Wrinkling. If paint is applied to a surface in thick coats, the surface skin of the paint dries without the under surface of the paint drying, which causes the paint to look like wrinkles. This is not an uncommon sight especially in exterior surfaces where paint has been applied without due care.

Bleeding. Sometimes if paint is applied over a knot without first covering the knot with shellac, the oil in the paint dissolves out the

substances in the knot which bleed through the paint and cause it to be discolored and undesirable in appearance.

Papering. On new plaster the same rules relative to natural and artificial aging should be followed. After the aging process takes place, sizing should be applied to the entire surface with a brush. After the sizing has become thoroughly dry, wall paper can be applied to the surfaces.

Calcimining. For new walls the aging specifications given previously hold true here. Also, sizing should be applied to the walls and ceilings and allowed to dry thoroughly.

Calcimine after being mixed, according to directions in Chapter III, is applied by using a large calcimine brush. The material is brushed on rapidly because it dries quickly, especially in a dry atmosphere. It should be brushed on with long even strokes. Experience is the best teacher in this regard, and with some experience the person calcimining will learn how to swing the brush so as to avoid making brush marks in the calcimine.

Before calcimine is applied to old plaster, the cracks should all be filled according to directions previously given in this chapter.

Calcimine should be applied to the ceiling first and then to the side walls. Calcimine for the ceiling is generally either white or a light tan or buff, and for the side walls it is somewhat darker in color to bring about a pleasing contrast.

Old calcimine can be removed easily by washing it off with a sponge and warm water. The sponge should be washed out frequently and the water changed frequently. All remaining traces of old calcimine should be washed off thoroughly and the wall allowed to dry before the new calcimine is applied.

Radiators. Radiators can be either covered with aluminum or bronze or they can be painted. It should be kept in mind, however, that if a radiator has originally been covered with bronze it is not advisable to attempt to paint it because the paint is almost sure to peel off in a short time.

Bronze or aluminum can be purchased ready to use and be brushed on the radiator in much the same manner as paint, although it acts somewhat differently than paint. If a radiator is being refinished with bronze or aluminum, a stiff wire brush should be used over the surface of the radiator to loosen and remove all scale.

If a new radiator is being painted, the color should harmonize with the color in the room. Regular paint may be used on the radiator, although this may be contrary to general opinion. It works out satisfactorily however, the only slight defect being that the heat from the radiator has a tendency to darken the paint. However, this process of darkening is not carried on to the extent where it is objectionable. However there are paints made and labeled for use on radiators especially, which can be purchased at all good paint stores. Or, paint using paste red lead, linseed oil, turpentine and liquid drier, in the amounts of 100 pounds of lead, 1⅞ gallons of oil, 1½ pints of turpentine, and 1½ pints of drier can be mixed and used satisfactorily, as a priming coat. If a light colored paint is required for the finishing coat, the second coat may be tinted to the exact shade and the formula can be based on the typical following formula: white lead, 100 pounds; lead mixing oil, 3 to 4 gallons. Generally flat finishes are desirable on radiators, although it is possible to purchase and obtain paint that will give a semi-gloss finish, too.

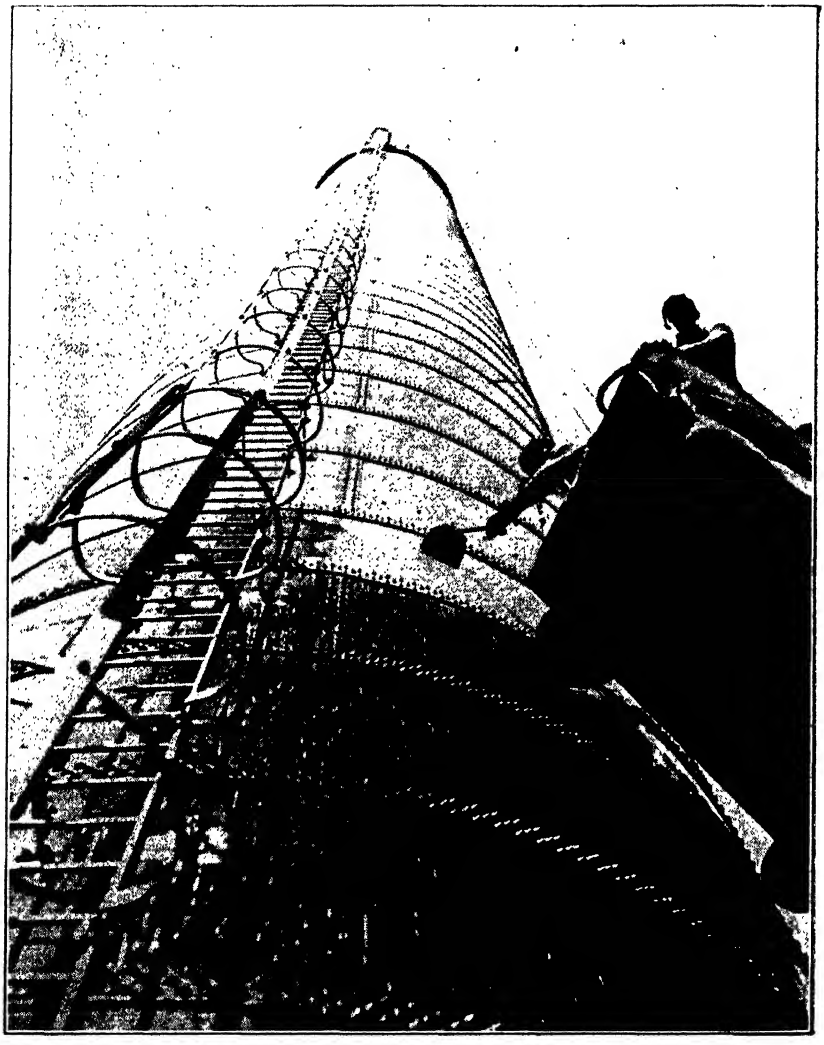
Wallboards. Painting or calcimining may be applied to wallboard in much the same manner as to plaster if a sizing coat is first applied to the wallboard. The cracks between wallboards and the nail holes should be filled with plaster of Paris or some other filler after the priming coat has been applied and then touched up with sizing over the cracks and nail holes. The second and third coat work is exactly the same as explained for plaster.

Various rigid insulations may be painted over to form a pleasing surface. Two and sometimes three coats of paint are necessary.

Miscellaneous Jobs. Clothes closets should be painted the same color as the rooms which they serve. It is not recommended that closets be calcimined because the calcimine is apt to rub off on clothes hung there.

Window sills are generally varnished, and it is recommended that an exterior varnish be used on them because the conditions under which they are used and which they encounter are almost equal to outside conditions. It is advisable to put a new coat of varnish on the window sills at least once every year.

Basement pipes can be very nicely painted using aluminum. This gives the pipes an attractive coating and preserves them from rust and other effects as well.



THIS ILLUSTRATES ONE OF THE MANY USES OF ALUMINUM PAINT
Courtesy of Aluminum Company of America, Pittsburgh, Pa.

CHAPTER VII

ALUMINUM PAINT

Aluminum paint, like other paints, consists essentially of a finely divided pigment dispersed in a suitable liquid or vehicle. It may be applied by the same methods as used for other paints; only minor modifications of technique are required to secure adequate and satisfactory results. Aluminum paint may be brushed, sprayed, or dipped. Its working properties may be adjusted to conform to all the accepted standards of flow, set, drying, and leveling that may be required of any kind of paint. Consequently, no fundamental difficulties interfere with its successful and general use as a protective and decorative coating.

While aluminum paint is similar to other paints in working properties, it is fundamentally different in the structure of its film. The aluminum pigment particles, instead of being granular in shape, are in the form of minute flakes. In the paint film these flakes do not occupy the entire space, but are arranged in more or less parallel layers, from 5 to 10 particles deep, with a thin cement of vehicle between each layer. The top layer of flakes forms an apparently continuous film of aluminum. This phenomenon is known as "leafing" because the flakes in the film are arranged much like fallen leaves. It is to this leafing action that aluminum paint owes many of its properties. Without leafing it would be only a gray-appearing film of limited application.

Pigment. The pigment for making aluminum paint is available in two different forms—as a paste and as a dry powder. The paste is manufactured in different grades, as is also the powder; each type and grade has certain properties which should be considered in any selection.

Aluminum paste comprises finely divided aluminum metal in flake form uniformly dispersed in a volatile paint thinner. It is produced by a new and revolutionary manufacturing process quite different from that used in making the dry powder. The paste process is fully protected by patents.

Aluminum paste offers a major improvement in aluminum pigments. The aluminum flakes are not only much smaller than can be conveniently produced by other processes, but also the thickness of the individual flakes is less than one-half that of most of the commonly used dry powder grades. This results in a substantial increase in pigment value and makes possible more durable aluminum paints with a reduced metal content. The standard paste contains only 65% metal, but it may be substituted pound for pound of dry powder in practically all aluminum paint formulations. The lower pigment weight improves the working qualities of the paint, and the extreme fineness of the flakes with their high polish produces aluminum paint films of unusual smoothness and brilliance at no increase in cost.

Aluminum paint made with paste pigment has good hiding power and opacity, principally because of the large number of flakes per unit weight. This is appreciated when attempting to hide dark or colored surfaces with one coat of paint. Because of this quality, greater coverage in square feet per gallon may be obtained without detracting from the appearance of the finished work.

Aluminum paste may be used in practically any case where aluminum powder is now used. Its many advantages (not the least of which is the mixing and handling) usually make it the preferable aluminum pigment to use for all classes of work.

The coarser grades of aluminum powder, commonly designated "Varnish" powders, are the ones used most widely for paint purposes. There are three principal "Varnish" grades of powder, differing chiefly in the maximum particle size as determined by the mesh of the commercial screens through which they are sifted during manufacture. Extra Brilliant Varnish Powder is the coarsest and in a paint film produces a uniformly rough, bright finish with good light reflecting properties. Standard Varnish Powder is appreciably finer and contains a larger percentage of small flakes. Consequently, paints made with this grade are not only more durable in weather exposure, but also the finish is considerably smoother. Standard Varnish Powder is used the most widely of the powder grades and is recommended for general-purpose applications. Extra Fine Varnish Powder, as its name implies, is still finer and when used in a paint supplies a film of good color and hiding power, with a texture that makes it suitable for use as a finish on manufactured articles.

Finer grades of both powder and paste have been developed for use where a finish of maximum smoothness and appearance is desired. Because of the small thin flakes of these grades, they possess high pigment value and may be used in much smaller quantities in the vehicle. The finish obtained by the use of Standard Lining Powder is similar to that obtained with Standard Paste in smoothness, while the color is slightly darker and more brilliant.

Two grades of Extra Fine Lining Paste are available, both of the same mesh size and fineness. The paints made with either of these grades give considerably smoother finishes than those made with Standard Paste. The pastes differ from one another in the nature of the volatile paint thinner used; the thinner in one is compatible with nitrocellulose lacquers and certain synthetic resin varnishes. This grade should be used in vehicles that do not permit thinning with mineral spirits. There is also an Extra Fine Lining Powder which makes a finish which is comparable with that obtained by the use of the Extra Fine Lining Pastes, but which is more brilliant, and looks much like chrominum plating when the coating is sprayed on a polished metal surface. Spray application is the best method of obtaining a smooth bright coating with this grade of powder, as well as with the Extra Fine Lining Pastes.

Vehicles. Aluminum paint has been found desirable for a large number of different applications and since the characteristics of the surfaces vary as well as the exposure conditions, it has become necessary to develop vehicles that will meet satisfactorily all possible services. The importance of selecting the right vehicle for the job cannot be over emphasized and is as vital as the securing of the best type of aluminum pigment. Care in choosing *both* will most surely produce the desired results.

Most of the vehicles suitable for use in making aluminum paint fall into three general classes,—those having a drying oil-resin base, those containing nitrocellulose as the film-forming base, and those formulated with pitch or asphalt.

Varnish vehicles are particularly well adapted for making aluminum paint because of their excellent spreading and covering characteristics. Varnishes also dry to a hard film more rapidly than linseed oil paints, and this is much to be desired for many purposes. Long oil or "Spar" varnishes, in particular, form with aluminum

powder, tough, elastic and durable paint films which are almost impermeable to moisture and quite resistant under severe atmospheric conditions.

A long oil varnish is one in which the amount of vegetable oil present exceeds the amount of gum or resin. Many of these, however, are so heavy in body that they must be thinned for use in aluminum paint. Such thinning, of course, reduces the proportion of the non-volatile oils and gums in the vehicle and this tends to reduce the durability. Therefore, a long oil spar varnish of just the proper consistency without thinning should always be used for exterior work. Chinawood oil is an essential ingredient in many of these varnishes and is valuable in increasing their resistance to penetration by moisture. The resin content of the varnish may consist of ester gum, coumarone resin, or a modified phenolic resin. This type of vehicle usually is between 40 and 50 gallons in oil-length and should produce an aluminum paint that dries to a hard, abrasion-resisting film of good elasticity and durability. It is recommended for use on weather-exposed metal surfaces and for the painting of the interiors of buildings subject to severe moisture conditions. It is not suitable as a priming or finishing coat for weather exposed wood.

There are a large variety of synthetic resins available for making varnishes and many of them yield products with interesting properties which render them especially suitable as vehicles for aluminum paint. Two of the most important classes of these resins are the alkyd resins and the phenolic resins. The phenolic resin base varnish is a "synthetic resin" varnish possessing unusual properties. It dries to a harder film than the ordinary long oil varnish but has much better elasticity and durability. Its moisture and chemical resistances are excellent and, because of its elasticity, it may be used as an all-purpose vehicle for aluminum paint on both metal and wood, exterior or interior. The somewhat higher cost of this vehicle is more than justified by the better protection it offers under severe conditions of exposure. Alkyd resin base varnish also offers improved elasticity and durability. Its rapid drying characteristics make it especially suitable for production finishes, but it may be used with equally good results on weather-exposed wood and metal surfaces. It is not recommended for the painting of concrete or other surfaces that may have an alkaline reaction.

When aluminum paint is used as a priming coat on wood, the vehicle should be more elastic than is usually necessary for other classes of work. Ordinary oleo-resinous varnishes should be much longer in oil than similar varnishes for use in painting metal. A varnish for use in priming wood is usually 60 to 80 gallons in oil length. Its greater oil length enables the coating to follow dimensional changes in the wood without cracking or flaking.

Pyroxylin solutions, sometimes popularly called "banana oil bronzing liquids," were among the first vehicles to be used in making aluminum paint. Their use was largely confined to interior painting and decorating, as they showed but slight durability on exterior exposure. However, the modern pyroxylin lacquers, such as those used as automobile and furniture finishes, are quite different in composition and will give good results where durable, rapid drying finishes are required. The present-day high solids and low viscosity lacquers make durable vehicles for aluminum paints that find many applications, particularly in production work. These lacquers are usually supplied in rather thick consistency, so that the user may dilute up to 100% with the special lacquer thinners recommended by the manufacturer. This type of vehicle is recommended for production finishes where quick drying is essential. Its durability over good priming paints makes it suitable for products that may be exposed to the weather.

Another type of vehicle which has found some application in aluminum paint finishes is the class of asphalt or bituminous base vehicles. The better grades of this type of paint consist of pitch or asphalt combined with suitable thinners and may contain drying oils and gums. When these dark-colored vehicles are mixed with a leafing aluminum pigment, the resultant paint produces a brilliant aluminum-colored surface. They especially are recommended by their manufacturers for use on composition and metal roofs, for waterproofing concrete and underground wood and metal surfaces and for general-purpose application. They should be used with caution where there is any likelihood of white or light colored oil paints being applied over this aluminum paint, as bleeding of the dark vehicle may occur.

For metal surfaces which reach relatively high temperatures, well diluted spar varnish may be used. However, special vehicles,

in the nature of gloss oil, have been commercially developed for use on heated surfaces and have proved successful, even at temperatures as high as 700° to 900° F., where not simultaneously exposed to the weather. The paint should be applied to the cold, clean metal surface and allowed to dry thoroughly before heating. A roughened surface will improve the adherence of the aluminum paint.

Spirit varnishes, such as shellac and bakelite lacquer, are also useful for certain classes of work. Aluminum paint made with such vehicles will be found to be fairly resistant to many solvents. The aluminum bakelite lacquer is also serviceable on heated surfaces.

Application of Aluminum Paint. Aluminum paste or powder can be stirred up with ease to a uniform mixture with the vehicle. It is, therefore, necessary to grind aluminum powder in the vehicle. The pigment as paste or powder should be carefully weighed and placed in a container large enough to more than accommodate the entire mixture. The correct amount of vehicle should then be measured in a separate container and poured over the pigment. In breaking up the paste pigment, it is important that the vehicle be added at first in small amounts and each addition be thoroughly mixed before more is added. Not over 10% of the volume of the vehicle should be used for the first addition, followed by another 10%, then 20% and finally the balance of the vehicle. The mixture should then be thoroughly stirred. The paint also should be stirred occasionally during application to keep the pigment uniformly distributed. Also the paint in the mixing container should be stirred each time any of it is removed, to assure uniformity of mix on the entire job.

The choice of the manner in which aluminum paint may be applied is not limited by the nature of the paint, since, as has already been pointed out, all of the standard methods of application are in successful use today. The most common method is by brushing. The brush should be not over four inches wide and made of long bristles of good quality. Short stiff bristles lead to over-brushing of the film and produce deep unsightly brush marks. The paint should be applied to the surface in the usual manner and well brushed out to a thin film, using minimum pressure. All final brush strokes should be made in the *same direction* and toward the lap with the previously applied paint. Do not start a return stroke beginning with the lap as this will inevitably leave a small excess of paint at the be-

ginning of the stroke which will dry with a different sheen and make the work look "blotchy." Once the paint is brushed out and the final wiping strokes toward the lap made, *do not touch the work or go over it again no matter how non-uniform it may appear.* If the paint has not been over-brushed and the setting time has not been too fast, this non-uniformity will disappear in four or five minutes and the film will dry out smooth and brilliant. However, if the brush is run over aluminum paint that has begun to leaf and set, it disturbs the pigment particles that have come to the surface, pushing them under again. Because the film is losing the volatile thinner rapidly by this time, the consistency of the vehicle has been greatly increased and the coating is now too viscous to permit the powder flakes to move freely in the liquid. The disturbed leafed area is, therefore, never completely replaced. This results in a strongly contrasting dark-colored streak that stands out with disagreeable distinctness against the brilliant, leafed surface on either side. For best results brush the paint on, lay it off, and then *leave it alone.* It will look all right when it is dry.

Spraying is another satisfactory method of applying aluminum paint. The spray gun is the best tool to use in applying aluminum paint, where large flat surfaces are to be painted. It permits the spreading of a uniform film, free of brush marks, and gives maximum leafing. There are air gun nozzles developed specially for use with aluminum paint and they are similar to those used for applying heavy oil base paints and enamels. Spray guns that operate at low pressures with high air volume are more efficient with aluminum paint because it is easily atomized. Too high a nozzle pressure causes excessive losses. The pressure on the tank can be held at any volume necessary to obtain good operation. The width of spray should not exceed 18 inches and preferably should be limited to about 12 inches to avoid fogging. Air agitation should not be used in the tank as this will cause some vehicles to thicken and it is also detrimental to leafing. An occasional turn or two on the hand agitator during continuous operation is sufficient to keep the paint uniform, but the paint should be stirred well if there is a long interruption, such as occurs at the lunch hour. The paint should be blown back out of the hose at this time or the settled pigment may cause clogging of the gun when spraying is resumed.

The high hiding power of aluminum paint may lead the operator to skimp the work and apply a film inadequate in thickness. If coverages are averaging better than six hundred square feet per gallon, the film is too thin and the gun should be opened up one or two turns. A film of aluminum paint too thin will dry flat with a whitish, dusty cast, while a good wet film dries with the full bodied brilliance characteristic of the brush job.

If any of the old paint remains in the mixing tank after the day's work, it may be mixed in with the freshly prepared paint, provided it does not exceed 10% of the volume of the new paint. In this manner the old paint may be used without spoiling the appearance of the work because of changes in color. It is advisable, however, to avoid adding more than 10% at any one time, unless tests indicate that the leaf-retention properties of the vehicle being used are better than average.

Aluminum paint may also be applied by dipping, and this method of coating manufactured products is recommended where the volume of work justifies it. Vehicles for dipping purposes must be almost tailor-made to suit each particular job. The paint manufacturer must formulate the liquid so as to have the correct flowing and baking properties and the leaf-retention of the vehicle must be exceptionally high. These requirements often make necessary the use of a lower oil content varnish of rather thin consistency, the subsequent baking operation helping to offset the lower durability characteristics of such a film. A number of such vehicles have been developed and are being used successfully on many different types of products.

The coarser grades of powder are not suitable for dipping operations because of their lower pigment value and the poor flowing properties of the resultant paint. The best results will be obtained with pigments having a mesh size similar to Extra Fine Lining Powder or Standard Lining Powder.

Dipping should not be selected as the means of applying aluminum paint unless daily replacements of new paint are high. The smaller the volume of paint in the dipping tank, the better the results will be. New paint should be added daily in amounts of 25 to 40% of this volume if the finish is to be uniformly bright and of good color. With vehicles of exceptionally good leaf-retention prop-

erties, this quantity may be reduced to as low as 10%. Tests should be conducted on the paint before definitely selecting the dipping method.

Properties and Advantages of Aluminum Paint. Aluminum paint is durable because the metal flakes are opaque to light and impervious to moisture. All drying oils are affected adversely by sunlight, particularly by the ultra-violet rays of sunlight. Continuous exposure to sunlight soon injures a varnish film unless it is protected by suitable pigments. The laminated structure of aluminum paint films assures protection to the binder and it is only by the slow weathering away of each succeeding layer that the time finally comes when the paint must be renewed. In protecting the paint vehicle from destruction, the surface underneath the paint is likewise protected. In actual service, aluminum paint has proven itself a good paint for protecting structural steel, wood, and all outdoor structures. This protective action of aluminum powder is due not only to its opacity to light, but also to its high reflectivity for light. Indoors, the utility of aluminum paint is just as marked and its bright, clean surface improves lighting efficiency with minimum cost.

Among the many unique properties of aluminum paint is its exceptional hiding power. The hiding power of a paint is its ability to obscure. In repainting a sign board, for example, it would be first necessary to obliterate the old design. The hiding power of aluminum paint can be demonstrated by painting it on a sheet of glass and holding it against an electric light. One uniform coat will hide the lamp filament completely.

Since the aluminum bronze powder is opaque to light, it is obvious why one uniform coat is all that is required for interior painting. However, for exterior work on unpainted steel or wood, two coats will give much better protection than one, and the use of at least two coats is to be recommended in such cases. In many instances in repainting structures where the undercoats are in satisfactory condition, one coat of aluminum paint is sufficient and other coats can be applied in succeeding years, thus increasing the protection rendered by the paint and decreasing the cost per year, while improving the average appearance.

The reflecting characteristics of aluminum paint are excellent. It reflects between 60 and 75% of light and radiant heat falling on

the surface. This feature is of value in most applications of aluminum paint. For example, it helps insulate structures, keeping the interior at a lower temperature. It increases the visibility of bridges, towers, and water tanks, and improves lighting efficiency on dark interiors. It protects the varnish film and gives longer life to the paint by reflecting instead of absorbing radiant energy.

Aluminum paint is immune to darkening in atmospheres high in sulphur-containing gases. Experience has also shown that aluminum paint, especially when made with paste pigments, stains less than does other paint when soot, dust, and water settles on it. The dust seems to wash and brush off readily leaving the paint film uniform in color, instead of with objectionable stains as is the case with so many light colored paints. Some users find that dust is readily removed from aluminum-painted walls by a compressed air blast.

Aluminum powder is, of course, non-poisonous; it is made of the same kind of metal as are cooking utensils. It can be used with safety for painting rooms where food is prepared and handled. The elimination of the danger of lead poisoning will be appreciated by every painter. In countries where the use of lead pigments is prohibited by law, aluminum paint should be indispensable.

One of the most valuable properties of aluminum paint is its low permeability to moisture. Numerous tests have shown that it is among the most impermeable paints. When the structure of the aluminum paint film is considered, this is not so surprising. The successive layers of aluminum particles forces the moisture to follow a much longer path around and between the innumerable flakes if it is to reach the underlying surface. This is equivalent to multiplying the film thickness several times.

The leafed surface of aluminum paint films makes possible the use of dark-colored vehicles, such as bituminous varnishes. The sealing action of the aluminum flakes makes aluminum paint useful over oil soluble stains, creosote, tar, asphalt, and decorative wood stains. The discoloring material dissolves in the varnish vehicle, causing it to darken, but since the surface of the powder in the leafed top layer is not wet by the vehicle, it continues to remain unaffected and bright. If the aluminum pigment has been mixed with an exceptionally good leafing vehicle, light-colored oil paints can be ap-

plied over the aluminum paint without further bleeding taking place. With soluble stains, additional coats of aluminum may be required.

A gallon of aluminum paint weighs about the same as water—a little over 8 pounds. This is less than half the weight of many other common paints and contributes somewhat to ease of brush application. The dried film weight is approximately 5.5 pounds per gallon. This factor is of some importance where saving in weight is desirable—such as on aircraft, battleships, and large bridges.

Uses of Aluminum Paint. Probably no other single paint meets as many requirements of use as does aluminum paint. In this chapter, however, it will be possible only to outline some of the various types of use to which aluminum paint may be placed.

One of its applications has been in the protection of structural steel. Aluminum paint is used widely as a protective coating for steel because not only is it durable, but also it is light in color, reflects light and heat, and has decorative value. It usually is used as the intermediate and finishing coats over red lead or other good inhibitive pigment priming coats. When properly applied to *clean,* rust-free steel, it gives excellent service in two and three coats without the use of a priming paint. The importance of a clean surface on which paint is to be applied cannot be over-emphasized in painting steel. If care is not taken in this work, much of the effort of the paint manufacturer to produce quality paints is wasted.

There have been many successful applications of aluminum paint to galvanized iron surfaces. Aluminum paint works on galvanized iron satisfactorily without a primer if the surface has been exposed to active weathering for at least six months. Where such weathering is out of the question, chemical treatment of the zinc surface prior to painting has been found of value in promoting paint adhesion. Treatments with solutions of phosphoric acid or copper sulphate or copper acetate have been found helpful.

Aluminum paint has good durability when used as a priming coat for such woods as southern yellow pine, ponderosa pine, Douglas fir, hemlock, and spruce. Its excellent adhesion to the wide bands of both spring and summer wood found in these species greatly improves the performance of the oil topcoats, adds several years of useful life to the paint job, and assures a good surface for repainting. On red cedar, redwood, and cypress, aluminum primers produce equally good

results, but the improvement is not so spectacular because of the better "paint holding" characteristics of these woods. Aluminum paint also is used frequently for both primer and finish coats where the silvery color is acceptable. The durability of a two- or three-coat aluminum paint job on lumber usually is more than twice that of oil paints. This makes it particularly useful for painting houses in industrial towns, summer cottages, and frame factory buildings.

The usual practice is to prime lumber after the building has been erected. Aluminum paint applied to the weather-exposed surfaces only, offers considerable protection to the wood against the effects of moisture, and the integrity and beauty of the finish is maintained for a long time. Of still greater value is the practice of painting the lumber on all sides with a coat of aluminum paint. Thus each board is sealed with a coat of metal protection, with the result that moisture changes in the wood are reduced much further.

Aluminum paint is efficient in the prevention of bleeding of oil soluble decorative wood stains. Light-colored topcoats usually may be applied over such stains when the correct aluminum paint is used first as an undercoat.

As a primer and second coat on water submerged surfaces, such as wooden boats, floats, and mine equipment, its water-resistant characteristic and good adhesion make it an excellent protective coating which reduces water absorption.

Destructive weathering of concrete has become a serious matter with maintenance engineers and many methods have been tried to prevent disintegration of surfaces of retaining walls, buildings, dams, and bridge piers. This deterioration is attributed in part to the action of water and frost, but much of it may be caused by the growth of crystals formed by a mineral salt solution held in and beneath the cement surface. Aluminum paint has proved successful in retarding or preventing this action of crystal growth by "waterproofing" the surface against rain and condensation.

The painting of brick usually is for purposes of decoration. It is believed, however, that two coats of aluminum paint on exterior brick surfaces may prevent water seepage through the wall, but the effect is probably limited in regard to sealing the mortar joints. On interiors with dark brick surfaces, aluminum paint finds one of its most useful functions—that of reflecting light and improving light-

ing conditions in plants and industrial buildings. It also serves in the same capacity on the walls of dark courts in crowded metropolitan areas. Painting of brick surfaces is a simple operation. One coat of aluminum paint will hide any colored brick, by either the application of a brush or spray gun.

Aluminum paint made with the long oil varnish vehicle (of *low acid* value and with a high China wood oil content) makes an excellent sizing coat for new plaster walls that have "aged" sufficiently. It also is used as a first coat in repainting old plaster walls that show bad hair-line cracks and suction spots. The aluminum pigment bridges over the cracks and fills them so that topcoats give a uniform appearance free from flat and glossy areas or lines.

Composition roofing is subject to deterioration because of the constant attack of sunlight and moisture. It has been found that the life of such roofing may be extended by the use of aluminum paint, particularly those made with bituminous varnish vehicles. Not only does such a coating protect the roofing material, but also it seals up small leaks that may have developed. Of equal importance is the fact that by presenting a light reflecting surface of brilliantly leafed aluminum flakes, a substantial amount of heat is reflected. No figures can be given on the effectiveness of aluminum paint in reducing interior temperatures because this will vary with the heat insulating characteristics of the roof itself; but the temperature difference between a black surface and an aluminum painted surface on a warm summer day may be as much as 10° to 40° F. depending upon conditions.

The high reflectivity of aluminum paint is being used extensively in interior painting in factories of every kind and description, from steel mills to candy factories. In the past it has been customary to paint machinery green, black, or with other dark colored paints. The use of aluminum paint on machinery has interesting possibilities in increasing the safety and efficiency of operation of such machines.

A number of engine rooms have been painted with aluminum paint, the paint being used on walls, steam lines, and the engines themselves. Little difficulty is experienced from staining of the aluminum paint by oil, since the paint usually can be cleaned readily, and the aluminum paint itself is not softened, or removed by lubricating oil.

Users always are surprised and pleased at the improved illumination obtained by substituting aluminum paint for the black or dark colored paints often used in storerooms, warehouses, vaults, passageways, etc. Such a finish also is economical because only one coat of aluminum paint need be applied to give a bright, clean looking surface.

There are available a number of aluminum paints that will withstand prolonged heating at temperatures around 1000° F. without changing color or losing their adhesion. None of these aluminum paints give satisfactory service on weather-exposed surfaces, since their heat resistance depends to a large extent on the absence of drying oils that give elasticity and durability to the other types of varnishes. The films must be thin for best results. When cold, such a film is quite brittle and is liable to crack if flexed to any great degree. Consequently, such liquids should not be used for painting stacks or stack breeching subject to the action of heating and cooling, rain, wind, and sunlight. Some vehicles, such as the glycerol-phthalate and phenolic types, give reasonably good results on heated stacks, but if these stacks are unlined and subject to temperatures above 600° F., the failure is quite marked. Because of its light color, aluminum paint on an unlined stack shows the areas that have flaked and peeled more than a dark-colored paint and the result is disfiguring and unsightly. On lined stacks and stacks operating at low temperatures, the color of aluminum paint is pleasing and the countless stacks so painted attest to the popularity of the aluminum finish for this work. The suggestion is made that the breeching and lower ring of the stack be painted black, as these sections have the highest temperatures. The top ring also should be black, as this is the place where most of the discoloration from the smoke occurs. The middle sections painted with bright aluminum paint will be an attractive contrast to the black portions and because of the lower temperatures will have a surprisingly long life. Lined stacks may be painted with aluminum paint made with the regular varnish vehicles and there are records of such stacks where the aluminum paint was in good condition after eleven years of service.

CHAPTER VIII

BRUSHES

Types of Brushes. Brushes are made in many different sizes and shapes. The quality of bristles, wood, setting of bristles, etc., also varies. Common brushes are made in such shapes as flat, round, oval, square across the end, rounded, painted, and chisel shaped, and may be wide or narrow. All painters have certain preferences as to brushes, but in general the large oval or flat brushes are used for applying paint on the bodies of houses or other places where there is plenty of room.

The smaller brushes—trimming or sash brushes—are used for painting sash, narrow trim, spindles, railings, lattice-work, furniture, corners, crevices and other parts too small to permit the use of the body brush.

These sash brushes come both in round and flat shapes. The choice between the two is a matter of personal opinion, although the old painters use the round brush, claiming that with the flat brush one is likely to allow the paint to flow rather than brush it in.

In no case are cheap brushes economical. The best brushes are made of bristles, while the cheaper brushes are made of horse-hair and lack the toughness, strength, elasticity or spring wearing quality and absorbing or paint-holding power of bristle.

Relative to grades of bristle, the painter should be careful not to get a brush with soft and flabby bristles, as a brush of this kind will not spread the paint properly. When this happens one is likely to waste more paint than the saving amounts to in the cost of the brush, to say nothing of the bad results obtained in the painting itself.

The amount of wear that a brush will give depends as much upon its care as upon its use. A brush which receives proper care will outlast two that are neglected. Under no circumstances allow the paint in a brush to dry and harden. When the paint in a brush is allowed to become hard, it is almost impossible to clean the brush and the bristles usually are ruined. Usually, it is cheaper to throw away such a brush than to attempt to reclaim it.

The value of a brush depends to a large extent on the springiness of its bristles. Once the bristles become soft and flabby, its usefulness is impaired. Putting a brush in water soon will cause the bristles to lose their springiness. For this reason, never keep a brush in water in the hope of keeping it in good condition. Never stand a brush on its bristle ends. When you want to use a brush succeeding days, suspend it in the paint which you have been using or in linseed oil. This may be done by drilling a small hole in the handle of the brush near the top of the ferrule, putting a wire through the hole and laying the wire across the top of the paint or oil container. Some brushes come with the hole already in them.

Cleaning Brushes. To clean brushes use turpentine, benzine, gasoline, or alcohol depending on conditions. A varnish or enamel brush should never be cleaned in anything but turpentine, and a shellac brush should never be cleaned in anything but denatured alcohol. Glue-set brushes should never be left standing in water and cement-set brushes should not be used in any finish that contains alcohol, such as shellac. After the brushes have been cleaned with either of the above agents they should be washed with soap and water and dried with a cloth. It is good practice to comb brushes so their bristles are all straight and put them away in moisture proof bags.

CHAPTER IX

ESTIMATING

General. Before home owners, for example, go ahead with painting jobs or decoration in general, they want to know how much the job is going to cost them. When a painting contractor talks with a client about painting, the first question the client asks him relates to how much the job will cost. Or, if a painting contractor tries to secure the contract for painting a new building, his first job is to submit a bid in which he states exactly how much money he requires for supplying material and labor. Some painting jobs are done on a basis of time and material (T and M) but the greatest majority of jobs are done by contracts in which the total costs are stated exactly. Thus it seems that a painting contractor should have some means of estimating costs for all types of work prior to doing the painting job.

Besides contractors who do their work in cities and towns, there are many farmers as well as other people living in rural localities who are interested in the cost of painting. Take the farmer, for example, who plans to do his own painting. He is interested only in the amount of paint and its cost. Some means of readily calculating such information also is necessary.

Paint dealers often are called upon, by their customers, to tell how much paint is necessary for given surfaces. Probably about eight out of ten people who buy paint, other than contractors, impose upon the dealer the task of telling them just how much paint they need to paint their barns, kitchens, etc. So it seems that paint dealers also should have some standard means of calculating amounts of paints necessary for various areas.

Estimates. Estimating is a process whereby the total amount of material or the total labor, or both, can be calculated for a proposed job before actual work gets under way. An estimate is a figure representing the total material, labor, or both required to do a job.

Estimating and estimates are what might be called *scientific* processes and exact approximations. Estimating is a matter of

opinion, judgment, and comparison, while estimates are the tabulated results of the estimating process.

Some people have been confused relative to the difference between an estimate and a cost analysis. It is advisable that the reader understand the difference between the two terms before going any further in this chapter.

In an estimate the amounts of labor and material are arrived at by the estimator's judgment, opinion, and his comparison of a proposed job with previously completed jobs. His judgment is based on study and experience, his opinions are based on his ideas relative to competent workmanship and what constitutes good material, and his comparisons are carried on by using previously completed jobs as a guide.

A cost analysis is a record of material and labor costs that *actually* were used and paid to complete a job. If a contractor, or other person doing painting work, keeps an accurate record of all materials and the total hours of labor necessary to complete a given job, he has a cost analysis of that job. A *detailed* cost analysis is an itemized record of how much material was required for so many square feet of siding, porch floor, walls, ceiling, trim, doors, stairways, etc., and how much labor, in hours, was necessary for each of these items.

The difference between an estimate and a cost analysis is therefore the difference between an *expected* cost and the *actual* cost for a given job.

How Estimates Are Made. The making of estimates is a complicated task and one requiring many operations and, in some cases, rather tedious calculations. However, with the proper method understood and the procedure outlined, the reader should have no trouble learning the process and putting it to profitable use.

The following part of this chapter explains the method and illustrates the procedure by means of an assumed job.

Not all estimators use the same methods and procedure, so it should be explained that the method and procedure herein illustrated is what we can call *typical.*

The following material first explains the various methods and procedure and then presents a typical estimate.

Estimating Forms. There is a large variety of forms used by

estimators and others for estimating material, labor, etc., costs relative to a proposed job. Therefore the forms herein illustrated must be thought of only as *typical* forms, or in other words, only one of the many procedures. Forms can be purchased from stationery stores or they can be homemade.

Before an estimate can be started, exact information must be obtained pertaining to what the job will cover. For new buildings there always is available what are called *Written Specifications.* These specifications are generally typed and should give complete information relative to all the painting work (see Chapter II). For a residence the specifications should tell what painting and finishing is required for every room plus any additional work on garages and in basements or storerooms, etc. The number of coats of paint, quality of paint, brand of paint, colors, etc., should be shown in addition to other directions for varnishing, calcimining, papering, etc. In other words the specifications should give full information so that no further questions need be asked.

Typical Forms. Forms used in estimating painting and finishing are of three general kinds commonly called *work sheets, quantity survey sheets,* and *estimating sheets.* There is a wide variation in their use. In this chapter the uses presented are typical.

Among some painters and contractors there has been a tendency toward omitting forms in favor of rough calculations, generally on scraps of paper or oral outlines of the work. Such a practice is not recommended because of the likelihood of errors, poor estimates, and generally poor workmanship. The forms explained in the following, while being somewhat laborious, are recommended because of their accuracy and good results.

Work sheets are illustrated in Figs. 11 and 12. These sheets can be used to advantage in connection with the specifications or in doing repair or redecorating jobs. Where there is a specification, the contractor first can study the blueprints and determine the various rooms. These can be written in the proper place in Fig. 12. Take the living room for example. From the specifications the painting and finishing for the walls, woodwork, ceiling, and floor can be determined and written in the proper places in Fig. 12. This procedure can be done for all rooms or areas. Any irregular areas can be mentioned in the space named *additional.* Then the finish, surface preparation,

WORK SHEET FOR PAINTING

EXTERIOR WORK

No._____ Date_____

Submitted to_____
(NAME OF PROPERTY OWNER)

Address_____

WORK ITEMIZED

	COLOR	SURFACE PREPARATION	Coats		COLOR	SURFACE PREP.	Coats
HOUSE: Body	White	)	3	Misc. Gates			
Trim	White	) One priming	3	Poles			
Roof		) Coat and 2) additional		Dog			
Sash	White	)	3	Trellis			
Screens				Concrete			
Blinds				Basement			
Door (outside)	Stain	Fill-Stain-Varnish					
Storm Sash							
Foundation							
Lining Brick				Attic			
Chimney							
Rain Gutters-Valleys	White		2				
Leaders	White		2				
Iron Work				Add'l.			
PORCH: Floor	Gray	) One priming	3				
Steps	Gray	) Coat and 2) additional					
Railing							
Ceiling		Semi-gloss					
GARAGE or BARN: Body							
Trim							
Roof							
Sash							

SASH:

Reputty in_____windows Glaze in_____windows

ADDITIONAL:

WORK SHEET FOR PAINTING INTERIOR WORK

No._____ Date_____

Submitted to_____
NAME OF PROPERTY OWNER

Address_____

	WORK ITEMIZED							
	LIVING ROOM				KITCHEN ROOM			
	Walls	Woodwork	Ceiling	Floor	Walls	Woodwork	Ceiling	Floor
COLOR	*Owner	White	White	Natural	White	White	White	
FINISH	Paper	Enamel	Calcimine	Varnish	Enamel	Enamel	Enamel	
SURFACE PREPARATION	Size	Sand	Size	Sand	Size	Sand	Size	
				Fill				
NO. OF COATS	1	3	1	2	3	3	3	
	DINING ROOM				BATH ROOM			
COLOR	Owner	White	White	Natural	White	White	White	
FINISH	Paper	Enamel	Calcimine	Varnish	Enamel	Enamel	Enamel	
SURFACE PREPARATION	Size	Sand	Size	Sand	Size	Sand	Size	
		Putty		Fill		Putty		
NO. OF COATS	1	3	1	3	3	3	3	
	BED (No. 1) ROOM				BED (No. 2) ROOM			
COLOR	Owner	Cream	White	Natural	Owner	Cream	White	Natural
FINISH	Paper	Enamel	Calcimine	Varnish	Paper	Enamel	Calcimine	Varnish
SURFACE PREPARATION	Size	Sand	Size	Sand	Size	Sand	Size	Sand
		Putty		Fill		Putty		Fill
NO. OF COATS	1	3	1	2				
	CLOSETS ROOM				BASEMENT HALL & WELL ROOM			
COLOR	White	White	White	Natural	White	White	White	Gray
FINISH	Flat	Flat	Flat		Flat	Flat	Flat	Gloss
	Paint	Paint	Paint		Paint	Paint	Paint	Paint
SURFACE PREPARATION				Sand				
	Size			Fill	Size		Size	
NO. OF COATS	3	3	3	2	2	2	2	3

ADDITIONAL:

All window sills varnished.

Exterior of windows painted 3 coats.

Basement stair well floor to be gray paint - 3 coats.

All doors stained mahogany except back door which is to be painted white.

Hall same as living room.

*Means owner to select.

Fig. 12. Interior Work Sheet

material, and number of coats can be written in for each room in the spaces provided. The exterior painting can be worked out by using the specifications and Fig. 11.

For a repaint, repair, or redecorating job, and where no written specifications are provided, the contractor can talk with the owner to decide which rooms, exterior surfaces, etc., are to be painted and write those names in Figs. 11 and 12. The materials, number of coats, etc., can also be filled in after talking with the owner.

In some cases these forms are made out in duplicate so that one copy can be given to the owner in place of specifications. With these sheets filled out and copies in the hands of both the contractor and owner there can be no chance of misunderstandings, errors in estimating, etc.

Quantity survey sheets are illustrated in Fig. 13. These sheets are used to list the amount of the various materials necessary for the work. Some contractors and estimators omit the quantity survey sheets and show the amounts only on the estimating forms, while others feel that greater accuracy can be had by using the survey sheets. It is a matter of opinion. Both forms are shown herein so the reader can use one or both, as desired.

In Fig. 13 the column headed "Dimensions" may be used in more than one way. For example, if there are blueprints of a job being estimated no dimensions need be put in this column because they can always be found on the drawing. The notation "See Drawing" may or may not be used as desired. If the job being estimated is a repainting job, it is not likely that there will be blueprints available, so the dimensions must be actually measured and written in the "Dimensions" column.

Fig. 14 illustrates typical estimating forms. It should be pointed out here that the forms illustrated in Fig. 14 are only one kind and that there are possibly 100 other kinds. However, all of them aim at the same end. The use of the three general forms is explained later in this chapter.

Rotation Method. Every painter or painting contractor has a particular method by which he goes about a job. In building a house, for example, the footings, foundations, basement columns, first floor plates, joists, rough flooring, and outside walls are constructed in the sequence just named. Structurally this is necessary to provide sup-

FIG. 13. QUANTITY SURVEY SHEET

Date_____ Survey Number_____

Owner_____ Sheet Number_____

Address_____ Surveyor_____

Architect_____ Checker_____

No.	ITEMS	DIMENSIONS	AREA OR LENGTH	AMOUNT OF MATERIALS
1	Exterior Walls	See drawing	1496	2 gal. prime coat
				4½ gal. finish coats
2	Oiling Sash	15 windows		½ gallon oil
3	Putty			5 pounds
4	Gutters and Spouts	See drawing	80	1½ quarts
5	Back Porch		58	1 pint priming paint
				1 pint second coat
				1 pint deck paint
6	Basement Stairway Plaster	See drawing	229	
7	Closet Plaster	See drawing	523	
			752	1 gallon priming
				1 gallon finish
8	Basement Stairs and Platform	See drawing	40	1 quart
9	Enamel Kitchen and Bathroom	See drawing	676	3½ quarts for priming
				3½ quarts second coat
				1 gallon enamel
10	Doors (15)			4 quarts stain
				4 quarts shellac
				4 quarts varnish
				1 pint spar varnish

FIG. 13. QUANTITY SURVEY SHEET

Date_____ Survey Number_____

Owner_____ Sheet Number_____

Address_____ Surveyor_____

Architect_____ Checker_____

No.	ITEMS	DIMENSIONS	AREA OR LENGTH	AMOUNT OF MATERIALS
11	Window Sills			Spar varnish—
				See doors
				1 pint stain
				1 pint shellac
12	Calcimine L.R.	See drawing	228	
	Sizing "		228	
	Calcimine D.R.		77	
	Sizing "		77	½ gallon gloss
				oil
	Calcimine B.R.#1		110	
	Sizing "		110	½ pint benzine
	Calcimine B.R.#2		144	
	Sizing "		144	9 pounds calci-
				mine
	Calcimine Hall		36	
	Sizing "		36	
13	Paper L.R.	See drawing	526	
	Glusize "		526	5 pounds glusize
	Paper D.R.		304	
	Glusize "		304	
	Paper B.R.#1		356	46 rolls paper
	Glusize "		356	
	Paper B.R.#2		390	
	Glusize "		390	
	Paper Hall		272	
	Glusize "		272	
14	Paste			8 pounds paste
15	Openings (36)	See drawing		2½ gallons prim-
				ing
				2½ gallons second
				coat
				2½ gallons enamel

FIG. 13. QUANTITY SURVEY SHEET

Date _____ Survey Number _____

Owner _____ Sheet Number _____

Address _____ Surveyor _____

Architect _____ Checker _____

No.	ITEMS		DIMENSIONS	AREA OR LENGTH	AMOUNT OF MATERIALS
16	Varnish	L.R.	See drawing	228	
	Filler	"		228	
	Varnish	D.R.		77	3½ quarts filler
	Filler	"		77	
	Varnish	B.R.#1		110	
	Filler	"		110	2 gallons varnish
	Varnish	B.R.#2		144	
	Filler	"		144	
	Varnish	Hall		36	
	Filler	"		36	
	Closets			35	
	Filler			35	

FIG. 14. ESTIMATING FORM

Date _____ Estimate Number _____

Owner _____ Sheet Number _____

Address _____ Estimator _____

Architect _____ Checker _____

No.	ITEMS	AREA	PIECES OR LENGTH	EST. AM'T MAT'L	MAT'L PRICE	MAT'L COST	EST. HOURS	LABOR PRICE	LABOR COST	ACTUAL COST AM'T MAT'L	ACTUAL COST HOURS LABOR
1	Exterior										
	Walls	1496		2 gal.	2.78	5.56	15	1.66	24.90		
	Exterior										
	Walls	2992		4½ gal.	2.75	12.38	30	1.66	49.80		
2	Oiling										
	Sash		15	½ gal.	.90	.45	1	1.66	1.66		
3	Putty			5 lbs.	.07	.35					
4	Gutters		80	1½ qts.	2.75	.66	½	1.66	.83		
5	Back	58		1 pt.	2.75	.35	1	1.66	1.66		
	Porch			1 pt.	2.70	.34					
				1 pt.	2.70	.34					
6	Basement										
	Stairway			1 gal.	2.70	2.70					
	and	752		1 gal.	2.75	2.75	4	1.66	6.64		
7	Closet										
	Plaster										
8	Basement										
	Stairs	40		1 qt.	2.70	.63	¾	1.66	1.23		
9	Enamel										
	Kitchen	676		3½ qt.	2.70	2.38	10	1.66	16.60		
	and Bath			3½ qt.	2.70	2.38					
	Room			1 gal.	5.00	5.00					
10	Doors		15	4 qt.St.	.60	2.40	12	1.66	19.92		
				4 qt.Sh.	.50	2.00					
				4 qt. V.	.80	3.20					
				1 pt.Sp.	.90	.45					
11	Window			1 pt.St.	.60	.30	3	1.66	4.98		
	Sills			1 pt.Sh.	.50	.25					
				1pt.S.V.	.90	.45					

FIG. 14. ESTIMATING FORM

Date _____ Estimate Number _____

Owner _____ Sheet Number _____

Address _____ Estimator _____

Architect _____ Checker _____

No.	ITEMS	AREA	PIECES OR LENGTH	EST. AM'T MAT'L	MAT'L PRICE	MAT'L COST	EST. HOURS	LABOR PRICE	LABOR COST	ACTUAL COST AM'T MAT'L	ACTUAL COST HOURS LABOR
12	Calcimine	595		½gal.oil	.90	.45	3	1.66	4.98		
	Sizing	595		½ pt. B.		.05	1½	1.66	2.49		
				9lb.Cal.	.06	.54					
13	Wall										
	Paper			46	.25	11.50	17	1.66	28.22		
	Glusize			5 lbs.	.25	1.25	4	1.66	6.64		
14	Paste			8 lbs.	.10	.80					
15	Openings		36	2½ gal.	2.75	6.88					
				2½ gal.	2.70	6.75	27	1.66	44.82		
				2½gal.E.	4.00	9.00					
16	Varnish	630		3½ qt.F.	.30	1.05	5	1.66	8.30		
	Filler	630		2 gal.V.	3.25	6.50	4	1.66	6.64		
		Totals				90.09			230.31		
		Total Cost							320.40		
		Profit 15%							48.06		
		Overhead							10.00		
		Total Estimate							378.46		

port for each structural detail. In painting work the foundation is the priming coats. The painter proceeds in a definite manner from priming and filling to the finishing coats. Ceilings are done before side walls. Trim receives its finishing coat before any of the wall paper is hung, etc.

It is recommended that the survey and estimate sheets be made up in the same sequence as the work is done. Such a policy will avoid omissions and tend to make possible more accurate estimates. If the estimator or contractor estimates the material and labor in exactly the same procedure as material and labor are used on the job, it is not likely that much material or labor will be overlooked.

Omissions are one of the greatest causes of estimates failing to properly price a job. It is easy to overlook special items of material and labor. Not many such items can be overlooked without seriously reducing the profit or even turning the job into a loss.

Check Lists. A check list is a list of all items requiring the attention of the painter plus materials most commonly needed. Such lists naturally contain many items not specified or required on an individual job. But, if the estimator reads through such a list and more or less checks each item with the plans and specifications of the job he is estimating, the chances of omissions are greatly reduced. As explained previously, omissions are one of the estimator's greatest enemies and any process that combats such an enemy is an asset.

Estimators and contractors can make easily such check lists for themselves by constantly adding new items as they are encountered on each new job.

A typical check list is shown in the following. This list does not constitute a complete list but will illustrate some of the necessary items.

TYPICAL CHECK LIST

Papering walls
Papering ceilings
Papering paste
Papering sizing
Canvasing
Sizing plaster walls for paint
Painting side walls
Sizing ceilings for paint
Painting ceilings
Sizing walls and ceilings for calcimine
Calcimining walls and ceilings
Priming walls and ceilings
Painting walls and ceilings

Enameling walls and ceilings
Stippling walls
Priming woodwork
Painting woodwork
Enameling woodwork
Filling woodwork
Staining woodwork
Putty
Waxing
Painting floors
Varnishing woodwork
Shellac
Varnishing floors
Painting radiators
Bronzing radiators
Priming window sash and frames
Painting window sash and frames
Painting pipes
Painting bricks
Painting concrete
Painting stone
Painting stucco
Painting stairs
Enameling risers
Varnishing stairs
Painting basement partitions
Painting attic floors
Painting siding and shingles
Staining shingles
Staining rough siding
Painting garages
Painting fences, gates, etc.
Painting porches
Painting metal
Painting gutters and downspouts
Painting flashing
Sandpapering
Painting closets
Blacking out duct interiors
Painting ducts or leaders
Painting miscellaneous basement jobs
Washing off calcimine
Taking off old paper
Removing paint
Removing varnish
Aging plaster
Back painting trim
Shellacking over old stain
Preparing old surfaces
Mixing paint
Paint
Varnish
Enamel
Calcimine
Calcimine coloring
Colors in oil
White lead
Mixing oil
Linseed oil
Turpentine
Shellac
Alcohol
Boiled oil
Putty
Sandpaper
Cloths
Filler
Stain
Driers
Red lead
Paper
Paste
Sizing
Plaster of Paris
Soap

Prices for Material. Prices for material vary in different localities. Therefore the prices for material shown in this chapter are only *typical* and used to make the estimate complete.

Estimators and contractors should maintain price books or other data sheets to keep the current prices of all the materials they buy. Such lists must be revised from time to time to insure their being accurate at all times.

Most estimators or contractors arrange to have their names on manufacturers' mailing lists so as to receive all new price lists and to keep posted on all allowable discounts for cash, etc. The contractor generally can save money by paying cash for all materials because it gives him a chance to take advantage of all cash discounts.

Most materials can be purchased in more than one grade and at varying prices. This item should be considered carefully and specifications read carefully to be sure the material prices used in estimates are correct.

Sometimes paint dealers make special arrangements with contractors. This is true especially where the contractor purchases all of his materials through one dealer.

Cost Records. No doubt cost records are the most helpful records the estimator or contractor can have. By cost records labor can be estimated and even material can be determined. Without cost records the making of estimates would become largely a matter of memory and the kind of judgment that depends on guessing. It is true that most contractors can tell *approximately* how long it will take one or more men to do a given task. But, the work *approximately* often means the difference between profit and loss. Now-a-days all contract work is highly competitive making it necessary for contractors to "figure their jobs close." Close figuring often is not possible by memory.

Some estimating forms carry columns devoted to estimated amounts of material, estimated total material cost, estimated amount or hours of labor, estimated total labor cost, and columns for actual material amounts and labor hours. The columns for the estimated items are naturally filled in with the estimated quantities, hours, costs, etc., before the job is started. However, the columns for *actual* material quantities and labor hours are filled in *during* or *after* the job is in progress or completed with the result that these figures repre-

sent the *actual* material and labor required. When the job has been completed, the *actual* figures can be compared with the *estimated* figures, and any errors, lack of judgment, or items omitted can be detected. With these figures as a guide, the next estimate to be made will be more accurate. When the results of several estimates and actual jobs are available, future estimating can be counted on to be even more accurate.

Some contractors go even further and make up a cost analysis for each completed job. Such an analysis should show the exact amount of labor necessary for painting areas of a given number of square feet, for varnishing certain areas, for priming a given number of windows, for painting a definite number of openings, for finishing a given number of doors, for hanging a given amount of rolls or area of wall paper, etc. Also, such an analysis should show the exact amounts of paint for priming certain areas and certain materials; for varnishing certain areas; for papering certain areas; for calcimining certain areas; and for filling and staining certain areas, etc.

The cost analysis method of determining labor and materials is recommended highly, especially for estimating painting. The amounts of concrete or numbers of brick can be estimated without previously obtained cost analysis figures because they fill exact spaces. For example, if concrete for a foundation or floor is to be estimated, the volume of the wall or floor can be calculated and thus the cubic yards of concrete can be estimated closely. Also the required number of bricks for a wall can be estimated closely by arithmetical methods. On the other hand, it is not possible to calculate the amount of paint required for a given area. The only estimating method possible is the one whereby records are kept of the areas covered by given quantities of paint.

The cost analysis records made by one contractor are not 100% accurate for use by another contractor. This is because one contractor may be an efficient organizer and possess the ability to obtain the maximum effort from his employees, whereas another contractor may be lacking in both of the above mentioned qualities and thus require more labor and even more material. The material and labor figures and estimating methods herein presented are from the records of an efficient contractor and may be thought of as good average figures and methods. The labor figures in terms of hourly wages, however,

COST ANALYSIS

Job No. 1067
Owner John Doe
Address 836 Main Street
Date 3/10
Foreman Jones
Estimator Wilson

DESCRIPTION OF BUILDING
ATTACH SPECS.
Wood frame with wood window sash and frames. Porches rear and front. Two story. Regular trim and plaster. Oak floors. Papered walls.

ITEM OR AREA	COATS	NO.	AREA	MAT'L SURFACE	PAINT MAT'L	AM'T PAINT MAT'L	HOURS LABOR	WEATHER	NO. OF MEN
Exterior walls-prime	1	-	2675	Pine	Reg.	4 gal	27	70°	3
" second	1	-	2675	"	"	4 gal	27	70°	3
" third	1	-	2675	"	"	4 gal	27	70°	3
etc.									
etc.									
etc.									
etc.									
etc.									
HAULING AND DEPRECIATION							2 hrs		1
MISC.									
TOTALS									

MISCELLANEOUS		REMARKS
PER CENT PROFIT	15	
TOTAL COST	675.00	
PERMIT	8.00	

Fig. 15. Typical Cost Analysis Form

are peculiar to the Chicago area and thus in other cities and rural localities must be thought of as simply typical illustrative figures.

Typical Cost Analysis Form. Fig. 15 shows a typical cost analysis form which can be made by anyone and used successfully. A few typical entries have been made for illustrative purposes. This form may be made in a number of variations from the one shown in Fig. 15 and the items can be listed in as much detail as desired. If the beginner will rule up similar forms and keep accurate records, his future estimates will be based on sound judgment.

Miscellaneous Costs. In addition to material and labor costs, an estimate must show all likely miscellaneous costs which in some cases might amount easily to a dangerously large amount if not included in the total cost.

Generally ladders, scaffolds, etc., have to be hauled from one job to another. If a motor truck is used for this purpose, the contractor may wish to charge each job with a certain amount for depreciation of the truck.

Ladders and scaffolds must be replaced from time to time and some contractors charge each job a certain percentage with the idea of gradually collecting a fund which will be available when new equipment purchases are necessary. Brushes, etc., come under this same consideration.

In some localities it may be necessary to take out a permit. This is part of the job cost.

Insurance sometimes must be taken out against accident to the job or employees.

There are numerous other items that may affect a job cost and which the contractor will learn by experience. The main thing is to learn to properly consider these items as important parts of an estimate.

Typical Quantity Survey Data. In the following series of questions and answers, a great many typical cost analysis results are presented. All of the figures represent actual information taken from the cost analysis and estimating files of a successful contractor who has been doing painting contracting for many years. This contractor has kept records of every contract he carried through to completion, in much the same manner as has been previously explained in this chapter.

These questions and answers are herein presented to show what can be accomplished by a good system of cost accounting; what data is absolutely necessary for a successful contractor to have; to give the beginning contractor a start; to assist the paint dealer and house owner; and to provide a basis for the typical quantity survey illustrative example given in this chapter.

It should be pointed out, as previously explained, that these survey figures are from the cost records of *one* contractor and that they reflect only his experience. Other contractors or other painters may have records similar which vary from the figures herein presented and these figures may not work out exactly for another person. However, they are typical and should prove helpful as well as illustrative.

QUANTITY SURVEY RECORDS

101. How is the amount of paint for exterior wood (siding) walls figured?

Answer. Most painting contractors figure that one gallon of paint will cover about 700 square feet. The area of the exterior surface is calculated by finding the combined area of all surfaces. Each side of a house, all ells, etc., must be included. For a square or rectangular shaped house the distance around the house can be multiplied by the height from foundation to roof. The amount of paint per coat is figured by dividing total area by 700. The answer is in gallons of paint.

102. How is the amount of paint for window sash and frames figured?

Answer. The sash and frames are painted at the same time as the wall surfaces and the amount of paint figured for these surfaces is ample for the window sash and frames. No additional paint need be considered.

103. How is the amount of paint for exterior door frames figured?

Answer. These frames are painted together with the outside wall surfaces and no additional paint is required.

104. How are window frames and sash figured on brick buildings?

Answer. They are considered as separate jobs because the wall surfaces require no paint. About 3 quarts of paint, per coat, is required for twenty windows or as they are called—twenty openings.

Ten openings require about ½-gallon of paint per coat. These quantities include painting frames and sash and tracing of putty.

105. How are exterior door frames considered for brick buildings?

Answer. Door frames are considered the same as a window opening. Therefore all doors are counted as openings the same as windows and the paint figured as explained in the previous answer.

106. How are windows and door frames handled on frame residences when they must be a contrasting color?

Answer. No additional paint need be assumed because the original paint can generally be tinted in small quantities for the frame color. The amount to tint can be figured on the basis of 3 quarts for twenty openings.

107. How is the amount of paint for cornices figured?

Answer. Cornice paint is included in the paint for exterior wall surfaces on frame buildings. For brick buildings the cornice area is figured and the amount of paint calculated on the basis of 700 square feet per gallon of paint.

108. If sash are to be stained on the interior, how much oil is required for priming coat?

Answer. ½ gallon of oil will prime the sash for about 50 windows.

109. How is the amount of sizing for steel sash figured?

Answer. Steel sash can be painted with about ⅓ the amount of paint required for wood sash. One quart of sizing paint should be ample for one coat on 20 steel sash.

110. How is the amount of priming coat figured for window sash and trim?

Answer. On the interior this is considered as one coat and the amount of paint figured as explained for Question 102. On the exterior the priming coat is put on at the same time as siding priming and no additional paint above the amount figured in the answer to Question 101 is required.

111. How is the amount of paint for interior window openings figured?

Answer. One window sash and trim and doors are each known as one opening. Also the base, picture moulding, etc., for one room is counted as one opening. For four such openings one quart of paint is required per coat.

112. How is the amount of paint for interior door frames figured?

Answer. Refer to the answer to Question 111.

113. How is the amount of paint for bases, picture moulding, etc., figured?

Answer. Refer to the answer for Question 111.

114. How is the amount of paint for interior floors and exterior porch floors determined?

Answer. For interior floors such as utility rooms, kitchens, etc., paint, as given in Formulas (19), (20), and (21), is often used. Priming coats cover about 600 square feet per gallon and second and third coats about 700 square feet per gallon. The areas are calculated by multiplying length times width. If the floors are irregular in shape, they can be broken up into squares, rectangles, triangles, etc., for ease in calculation.

For exterior floors, such as porches, deck paint is sometimes used. Such paint covers about 400 square feet per gallon. For first and second coats paint as given in Formulas (19) and (20) is sometimes used. In this case use coverages of 600 and 700 square feet per gallon for these coats.

115. How is the amount of paint figured for brick, stucco, and concrete wall surfaces?

Answer. Calculate the areas of such surfaces by multiplying total length by height. Do not deduct for openings unless there are several and at least as large as ordinary windows. One gallon of paint covers about 600 square feet. Thus, if there were 2400 square feet of surface, the amount of paint would be $2400 \div 600 = 4$ gallons.

116. How is the quantity of paint for concrete floors determined?

Answer. Generally, such paint covers about 400 square feet per gallon.

117. How is the quantity of enamel figured for windows?

Answer. Enamel for trim provides about the same coverage as ordinary paint. In some cases it covers a little less per gallon.

For interior windows the process is the same as given in the answer to Question 111. Some contractors assume that enamel covers about 10% more than paint although such a practice is sometimes risky.

118. How much paint is required for interior doors?

Answer. Interior paint generally covers about 700 square feet for

the priming coat and 800 square feet for the second and third coats. The areas of doors are figured by multiplying length by width and then multiplying by two because of two sides. Some contractors add two or three additional square feet to take care of bevels on panels, etc.

119. How is the amount of enamel for wood doors figured?

Answer. Most painters assume that enamel covers about the same as paint or maybe 10% more.

120. How is the amount of paint for shingled walls determined?

Answer. Such paint covers about 600 square feet per gallon. The areas are found as explained in the answer to Question 101. Thus, a residence having horizontal dimensions of 30 x 50 feet and 20 feet high has an area of $30 + 50 + 30 + 50 = 160$ lineal feet. Then $160 \times 20 = 3200$ square feet of surface. Amount of paint per coat is $3200 \div 600 =$ approximately $5\frac{1}{2}$ gallons.

121. How is the quantity of paint for porch railings, columns, and porch ceilings figured?

Answer. The area should be calculated. For ceilings area calculations are simply carried on by multiplying length by width. For railings, columns, hand rails, etc., the estimator must either be able to judge by sight or go through the laborious task of actually figuring the areas of the various items. Pickets and other items can be roughly estimated by assuming the whole railing as a solid and adding the areas of both sides. Hand railings can be figured like columns. For example, a hand railing can be assumed cylindrical in shape and the area figured as per rule for face areas of cylinders. Most paint used for such areas will cover about 700 square feet to the gallon.

122. How is the amount of material for starching figured?

Answer. This item is almost too small to be considered because a 10 cent package of starch and a handful of ivory flakes will be ample for starching a 5-room house.

123. How is the quantity of stippling paint figured?

Answer. Stipple paint covers about 350 square feet per gallon. The area of walls is figured by multiplying height by width of each wall or by multiplying the lineal distance around the room by the height. No openings are deducted unless very large and numerous.

124. How is the quantity of undercoating for stippling figured?

Answer. Paint used for undercoating covers about 800 square feet per gallon.

125. How is the quantity of wax figured?

Answer. One pound of paste wax covers about 250 square feet.

126. How is the quantity of paint for painting gutters and downspouts figured?

Answer. Two quarts of paint will generally cover 250 lineal feet of gutter or downspout when new and if the tinsmith has given them a coat of red lead. Old gutters and downspouts require about three quarts per 250 lineal feet.

127. How is the amount of paint for basement partitions figured?

Answer. The type of paint generally used for wood partitions generally covers about 700 square feet per gallon. The area is calculated as for walls. The area must be multiplied by 2 if both sides of partition are to be painted.

128. How is the amount of paint for interior stairs figured?

Answer. Paint will cover at the rate of 700 square feet per gallon for priming coat and 800 square feet per gallon of second and third coats. The areas of treads, risers, and stringers can be calculated by multiplying length by width. For railings the area can be roughly figured as explained in the answer to Question 121.

129. How is enamel quantities figured for stairs?

Answer. As explained in previous answers, some enamels cover more area per gallon than some ordinary wood paints. This can be ascertained by the consistency of the enamel. If it is thin and brushes easily, 800 square feet can be counted on per gallon whereas if it is thick its coverage may go as low as 450 square feet per gallon. This question depends on experience, to a large extent, for its answer and on a knowledge of the paint or enamel being used. Figure areas as explained previously.

130. How is the quantity of paint for walls and ceilings figured?

Answer. The areas of ceilings are calculated by multiplying length by width. The areas of sidewalls are calculated by multiplying the length of each wall by its height. Deductions for windows and doors can be made if they are not to be painted like the plaster. One gallon of wall primer covers 800 square feet of plaster area. One gallon of second or third coat paint also covers about 800 square feet.

131. How is quantity of enamel for plastered walls figured?

Answer. The type of gloss enamel generally put on walls will cover about 700 square feet per gallon.

132. How is material for kitchen cabinets figured?

Answer. The area must be roughly figured. Then paint or enamel can be calculated depending on the covering quality. Where cabinets are to be stained and varnished, some contractors figure the cost at 1½ cents per square foot.

133. How is the quantity of gloss-oil figured?

Answer. One-half gallon of gloss-oil cut with 1 pint of benzene will generally cover about 650 square feet.

134. How is the amount of calcimine figured?

Answer. The area to be calcimined should be determined. One and one-half pounds of calcimine is ample for 100 sq. ft. of surface.

135. How is the amount of glusize figured?

Answer. Soak 1 pound of glue in ½ gallon of cold water. This must later be boiled. This quantity makes ½ gallon of glusize which will cover 300 square feet.

136. How is the number of rolls of wall paper figured for a room?

Answer. See Table I. This table can be used with good accuracy. When using the table, look for the height of ceiling at top of column, size of room in the left-hand column. The figures in the table give the number of rolls required. Deduct *two single rolls* of sidewall for every *three* ordinary windows or doors.

137. How is paper waste taken care of?

Answer. A double roll of paper 18 inches wide contains 48 running feet of paper. Out of this roll 5 strips can be cut for a room of standard height. There is usually a remnant left. As a rule these remnants are ample to take care of any spoilage.

138. How is the quantity of paste figured?

Answer. One-half pound of paste will be ample for 100 square feet of paper.

139. How is the quantity of putty figured?

Answer. For an ordinary 6-room residence, a contractor would buy about 5 pounds of putty.

140. How is the quantity of filler determined?

Answer. One quart of paste filler takes care of about 175 square feet of surface.

141. How is the quantity of floor varnish determined?

Answer. Most contractors assume that one gallon of varnish will cover about 700 square feet.

142. How is the quantity of stain figured?

Answer. Stain covers about 500 square feet per gallon.

143. How is the quantity of stain and filler for doors determined?

Answer. By the area. Stain and filler have the same covering capacity of about 500 square feet per gallon.

144. How is the quantity of bronze figured for radiators?

Answer. It is necessary to ascertain the rating of the radiators in square feet. Such data may be obtained from catalogues published by radiator manufacturers. One gallon of liquid bronze will cover 1,000 square feet of radiator surface one coat.

145. How is quantity of paint for radiators figured?

Answer. Five quarts cover 1,000 square feet one coat.

146. How is the quantity of paint figured for pipes?

Answer. One gallon of bronze covers 3,000 square feet of 3-inch pipe. Other pipe sizes in proportion.

147. How is the quantity of stain for roof shingles determined?

Answer. Most shingle stains cover about 150 square feet one coat per gallon.

148. If window sills for a 6-room residence require spar varnish, how much is needed?

Answer. Most contractors assume one pint sufficient.

149. How is varnish removal on floors figured?

Answer. Where a varnish remover is used, generally contractors figure the entire cost of material and labor at 7 cents per square foot. Where machine sanding is done, the cost is about 4 cents per square foot.

150. How is the quantity of canvas figured?

Answer. Same as for wall paper.

151. Where interior and exterior doors are to be stained, shellacked, and varnished, how is the material figured?

Answer. The materials can be figured on a basis of 4 doors. On this basis 4 doors require about one quart of stain and one quart each of shellac and varnish.

Doors can also be figured individually as per data in other questions and answers of this series. However, contractors usually prefer the method outlined above.

Typical Labor Records. The following series of questions and answers, like those for quantity surveying, have been taken from the

cost analysis records of a successful painting contractor. These labor records are herein presented for the same reasons as outlined under "Typical Quantity Survey Data" and are subject to the same explanations relative to other contractors, painters, and house owners. The figures given should not be viewed as hard and fast rules for labor nor as any exceptions to any Union rules or regulations. They should be viewed simply as the labor records of one successful contractor.

LABOR RECORDS

201. How is labor for exterior siding figured?

Answer. A good painter will paint on an average of 100 square feet per hour.

202. How is labor for exterior windows and doors figured?

Answer. On frame residences the labor for the siding includes the windows and doors.

For brick buildings a painter ordinarily will paint 20 window openings in 6 hours. This includes door openings.

203. If exterior trim must be painted a contrasting color, how is labor figured?

Answer. No additional labor.

204. How is labor for painting gutters figured?

Answer. If gutters and spouts are on the ground, allow 30 minutes for each 250 lineal feet. If already hung, allow 60 minutes for each 250 lineal feet.

205. How is labor figured for basement partitions?

Answer. The average painter will cover about 200 square feet per hour. Thus, if there are 700 square feet of partitions, allow about 3½ hours labor for each coat.

206. How is labor for stairs figured?

Answer. For interior stairs, as from first to second floors, the average stair requires about 5 hours per coat. Stairs form an intricate problem and the labor estimate depends largely on practical experience. The beginner will do well to consult an older or more experienced painter on his first few jobs.

For basement or exterior or attic stairways the labor time can be based on the labor rate in Question 222.

207. How is the labor for painting ceilings and interior walls figured?

Answer. An experienced painter will average about 200 square feet per hour. This includes trim.

208. How is the labor for interior windows and doors figured when they are painted or enameled?

Answer. All windows and doors are classed as openings. One painter will paint or enamel one coat on 4 openings per hour.

209. How is labor for cased openings, trim, base, etc., figured?

Answer. The cased openings are classed as openings as in the previous answer. The trim in an ordinary room is classed also as one opening. Thus these items are all included in the 4 openings per hour rate of the previous answer.

210. How is labor for oiling new sash figured?

Answer. When oiling is done, the labor is figured at the rate of about 50 windows in two hours time.

211. How is labor for painting steel sash figured?

Answer. On new steel sash one man should paint 6 ordinary sized sash per hour. On old sash about 25% more time should be allowed.

212. How is labor figured for gloss-oiling?

Answer. Allow 1½ hours time for every 650 sq. ft. of surface.

213. How is scaffolding labor considered?

Answer. This is included in all labor figures. Experience teaches how much more labor to add. In these answers the labor includes all scaffold time.

214. How is labor for calcimining figured?

Answer. Allow 30 minutes per 100 square feet. As an example, suppose a ceiling of 180 square feet were to be calcimined. One workman should not require more than one hour to patch, put up and take down scaffolds, and calcimine the entire area. This does not include washing off old calcimine.

215. How is the labor for glusizing figured?

Answer. An average painter will glusize 200 square feet of surface in about 30 minutes.

216. How is the labor for hanging paper figured?

Answer. For good butt jobs the paper hanger should be allowed 2 hours to hang 200 square feet. For one-edge jobs less time is necessary and only 1½ hours is allowed per 200 square feet. These figures assume that walls are in good shape.

217. How is the labor for removing old paper figured?

Answer. By using steam a workman can remove about 200 square feet of old paper in an hour. If there are more than 2 or 3 thicknesses of old paper, allow at least 1½ hours for 200 square feet. Without the steam machine it would be difficult to estimate the labor. Most contractors do this type of work on a time basis only.

For the average size room allow from 30 to 60 minutes for washing, sanding, and patching.

218. How is labor figured for removing old calcimine?

Answer. Allow 45 minutes for 200 square feet when only one layer of calcimine is to be removed. Where more than one coat must be removed or if the surface has been previously "skinned," allow up to double the labor time required for one coat removal. These figures allow for cleaning up time.

219. How is putty labor figured?

Answer. No special time is considered for puttying as the other labor figures include it.

220. How is labor for filling figured?

Answer. A workman will fill and rub off 125 square feet of surface in about 45 minutes. For first-class work, including sweeping and making ready for varnishing, a workman will fill about 1,000 square feet of flooring.

221. How is labor for varnishing figured?

Answer. For floors an allowance of 1,500 square feet in 6 hours is a good average figure. Time for sweeping and sanding included. For woodwork figure one cent for each square foot per coat.

222. How is labor for painting floors figured?

Answer. One workman should cover about 200 square feet per hour per coat.

223. How is the labor for removing old paint and varnish figured?

Answer. Most contractors refuse to make estimates for removing old paint and varnish either by a torch or an acid remover. This job should be done on a straight time basis because of the many uncertainties encountered.

224. How is labor for interior and exterior stained doors figured?

Answer. It takes about one hour to sand and stain 4 doors. Allow the same time for shellacking and varnishing.

225. How is the labor for painting doors figured?

Answer. All such doors to be painted should be added as to area (both sides) and the labor estimated at about 5 doors per hour per coat.

226. How is labor for bronzing or painting radiators figured?

Answer. The average workman should be able to cover 900 square feet in 6 hours. The bronze, in some instances, may take only five hours. These figures are per coat.

227. How is the labor for painting pipes figured?

Answer. A workman should be able to paint a 3-inch pipe at the rate of 2,500 lineal feet in 6 hours. Other pipes in proportion.

228. How is the labor figured for painting sidewall shingles?

Answer. One workman can prime coat about 125 square feet of surface per hour. The second and third coats go on at the rate of 150 square feet per hour.

229. How is labor figured for staining roof shingles?

Answer. One workman can stain 200 square feet per hour.

230. How is the labor for varnishing window sills figured?

Answer. The window sills of an average six-room residence could be varnished in one hour.

231. How is labor for washing interior paint figured?

Answer. If walls have been starched, one workman can wash about 450 square feet in three hours. For walls not starched no figures can be given here because varying conditions cannot be anticipated. Where walls are greasy and dirty, the washing time mounts high. The best way to handle such labor time is to put it strictly on a time basis at so much per hour.

232. How is starching labor figured?

Answer. In the ordinary room where furniture must be moved, around 1½ hours should be allotted. In empty rooms this time can be reduced safely to one hour. For large or very small rooms the time should be proportioned accordingly.

233. How is the labor for stippling coat and stippling figured?

Answer. For these two operations allow about two hours for 200 square feet of surface.

234. How is waxing labor figured?

Answer. One workman can wax about five case openings per hour or about 175 square feet of floor per hour. This time includes

applying wax and polishing only. Time for scrubbing and washing, if necessary, should be about the same as for waxing.

235. How is canvassing time figured?

Answer. For sidewalls the cost of applying canvas is about the same as for paper hanging. For ceilings the wall time should be doubled because two workmen are really necessary.

236. How is labor for painting porch railing, columns, etc., figured?

Answer. The area is calculated as explained in the "Quantity Survey Records." The labor time is then based on the time allotted for exterior painting, except that for intricate pickets, etc., the time can be increased from 30 to 50%.

237. In staining, shellacking, and varnishing doors in groups of 4, how is the labor figured?

Answer. Allow one hour for four doors in staining work and one hour each for shellacking and varnishing four doors.

ILLUSTRATIVE EXAMPLE

Figs. 16 and 17 show elevation and floor plan sketches of a typical low cost house commonly built in suburban or rural areas.

It is required to estimate the total cost of materials and labor for painting and finishing this house complete. It can be assumed that we are making up an estimate for the purpose of bidding or, just to let the owner know how much the job will cost.

The structural features of the house are as follows:

Walls: Frame construction using 2x4 studs, rigid insulation as sheathing, wood siding, lath and plaster.

Roof: Cork shingles.

Interior Walls: Lath and plaster.

Windows: Wood sash and frames.

Front Entrance: Brick platform.

Rear Entrance: Platform of wood. Steps are wood treads without risers and with stringers on both sides.

Floors: All floors oak except kitchen and bathroom. Kitchen is to be covered with linoleum and the bathroom floor is tile.

Closets: Plastered throughout. Floors of oak.

Basement Stairs: Plain wood treads without risers. Stringers on both sides.

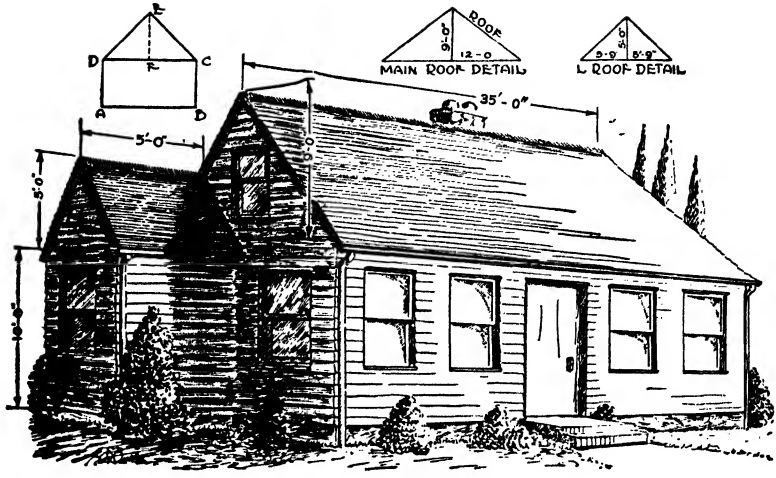


Fig. 16. Elevation

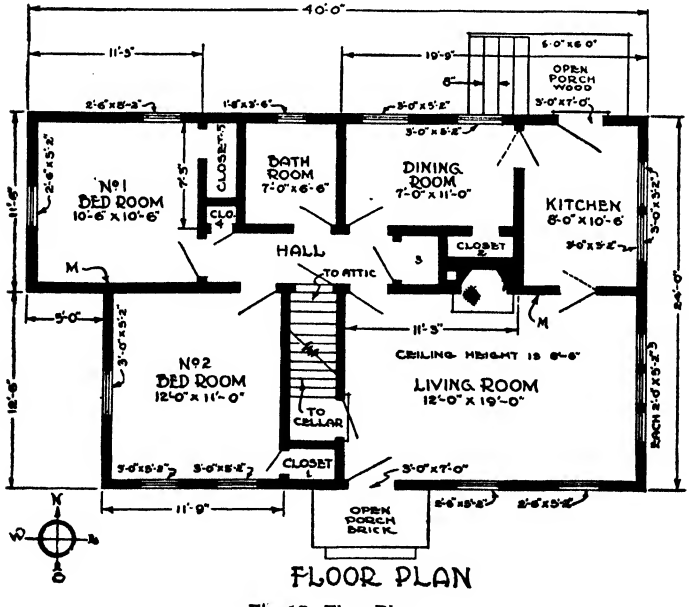


Fig. 17. Floor Plan

Stairway: The basement stairway is plastered on sidewalls and on under side of attic stairs. The platform at head of stairs is pine.

Fireplace: All masonry.

Gutters and Spouts: Paint required.

QUANTITY SURVEY

Solution. Ordinarily for new houses the written specifications would be made out like those shown in Chapter II, except that specific references would be made to the various items and areas requiring painting or finishing. Here it can be assumed that such a specification has been studied and that the items shown in the work sheets, Figs. 11 and 12, have been taken from the specifications.

Following the recommendation previously made relative to the use of estimating forms, this solution has already made use of the work sheets and in the following shows and explains how to calculate and fill in the quantity survey and estimating forms.

In the following solution, the quantities calculated are shown in the "Quantity Sheets" (Fig. 13). The material prices, material costs, labor estimate, and labor costs are shown in the "Estimating Sheets" (Fig. 14).

It is necessary to make the quantity survey first.

Exterior Walls. (See *Item 101 in Quantity Survey Records, page 124.) One way to calculate the area of the sidewalls would be to multiply the distance around the building by the average height. However, a more accurate method would be to divide the building up into geometrical figures and find the area of each figure. This will be done in this solution.

The south side of the main structure (Fig. 16) is 35′0″ long and 10′0″ high. The area of this side is therefore 35x10=350 square feet. The east end of the structure is composed of a square and a triangle—see detail ABCDE in Fig. 16.

To find the area of this end, it is necessary to find the areas of the square (ABCD) and the triangle (CDE) separately.

The square is 24′0″ by 10′0″ or 240 square feet in area. The triangle can be divided into two right-angled triangles by the line EF. Then DF and FC each equal 12′0″. The line EF is 9′0″ (see main

* All item references in the "Quantity Survey" refer to items coming under "Quantity Survey Records."

roof detail). The area of a right triangle is ½ the base times the altitude. Thus 12x9=108 and 108 divided by 2 is 54. There are two such triangles so the area of CDE is 2 times 54 or 108 square feet.

The north side is exactly the same as the south side.

The west end can be calculated after the ell.

The south side of the ell is 5′0″ long and 10′0″ high or 50 square feet.

The north side of the ell is the same area as the south side.

The west side of the ell consists of a square and a triangle. The square is 11′6″ long and 10′0″ high or 115 square feet. The triangle (see ell roof detail) is composed of two right triangles each having a base of 5′9″ and an altitude of 5′0″. The area of one triangle is 5′9″ x 5′0″=28 and 28÷2=14 square feet. Then the two triangles are twice 14 or 28 square feet.

The area of the west side of the house can be easily calculated by subtracting the area of the west side of the ell from 348 (area of east side). Thus 348—143=205 square feet.

The entire wall area of the exterior is therefore

350 South side main structure
108 East triangle main structure
240 East square main structure
350 North side main structure
50 South side ell structure
50 North side ell structure
115 West square ell structure
28 West triangle ell structure
205 Uncovered part west ell structure

Total Area=1496 square feet.

This area includes all windows and doors and is put into the "Quantity Survey Sheet" (Fig. 13).

Knowing the total square feet of wall surface (including windows and doors) to be painted and knowing that one gallon of paint will cover 700 square feet per coat (item 101) the amount of paint for three coats can be determined by dividing. Thus 1496÷700=approximately 2.1. Then 2.1x3=6.3 gallons which would generally be called 6½ gallons. However, in most instances the priming coat would be a different formulation from the second and third coats. Therefore the prime coat is listed at 2 gallons in the survey sheet

(Fig. 13) and the finishing coats listed at approximately 4½ gallons.

Oiling Sash. For extra protection some architects insist that all sash be given a coat of linseed oil just as soon as they are delivered to the job and installed by the carpenter. Not all jobs include this extra item but it is a good practice and does not cost much in addition to the standard practice.

In item 108 the amount of oil required where sash are to be stained is approximately ½ gallon for 50 windows. No staining is being done to the windows on this job but the quantity figure for oil is applicable just the same. In Fig. 13 one-half gallon of oil is recorded. This amount is more than enough but the excess can always be used around a job.

Putty. (See item 139.) Five pounds of putty is necessary on the average six-room residence.

Gutters and Spouts. It is assumed that the tinsmith puts one coat of red lead on so the painter need only put two coats of paint on to complete the job. On some jobs the downspouts are without red lead. Also on some jobs only one coat of paint is applied. In this example we will assume that the downspouts are painted along with the exterior walls and that no extra paint is required. However the gutters will require paint. Item 126 shows that two quarts of paint will cover 250 lineal feet of gutter. In Figs. 16 and 17 there are gutters necessary on the north and south sides of the main structure and ell. The total length on the north side, including the ell is 40′0″ and the same distance is good for the south side. So 80′0″ of gutter require painting. If two coats are applied, we can assume 160′0″ of gutter. Then at the basis given in item 126 only about 1½ quarts of paint are necessary.

Back Porch. To estimate the material necessary for the porch and steps, it is necessary to calculate the total area. The platform area is 5′0″ x 6′0″=30 square feet. The steps are actually 8 inches wide but for convenience and to allow for edges they are assumed at 12 inches. The steps are each, then, 1′ x 5′ or 5 square feet in area. There are four steps so their combined area is 4 x 5=20 square feet. The stringers can be assumed as 10 inches wide and 4 feet long. For convenience assume each is 1 x 4 feet or 4 square feet. Two stringers make 8 square feet. The total area for the back porch is thus 30+20+8=58 square feet.

The first coat is primer and the second coat regular paint as for exterior walls. The third coat is assumed as deck paint.

The amount of priming paint is figured as explained in item 101. At that basis a pint of priming paint and a pint of second coat will be more than enough. Item 114 shows that deck paint covers 400 square feet per gallon so for 58 square feet one pint will be sufficient.

If mixed-on-the job paint is used, some amount of color in oil will be necessary to make the gray final coat for the porch. However, this is not considered here.

Basement Stairway and Closet Plaster. The plaster areas receive two coats in both stairway and closets.

The area on the stairway ceiling will be sloping because of the attic stairs above. This ceiling can be figured as 3′0″ x 9′0″=27 square feet. The walls can be figured as usual because the stairs both slope parallel. Then $2(9 \times 8\frac{1}{2})=152$ which is the area of the walls of the long dimension. Also $2(3 \times 8\frac{1}{2})=50$ square feet which is the area of the short dimension wall. The total area is $27+152+50=229$ square feet.

The plaster area in the closets must be figured to include the walls and ceilings and wood shelves. The dimensions are assumed (scaled) as follows:

Closet No. 1	Dimensions 3′ x 2′ x 8½′ Shelves (2) each 1′ x 3′
Closet No. 2	Dimensions 4′ x 1½′ x 8½′ Shelves (4) each 1′ x 1½′
Closet No. 3	Dimensions 2½′ x 3½′ x 8½′ Shelves (2) each 1′ x 3½′
Closet No. 4	Dimensions 1½′ x 1′ x 8½′ Shelves (5) each 1′ x 1½′
Closet No. 5	Dimensions 5½′ x 2′ x 8½′ Shelves (2) each 1′ x 2′

The total wall and ceiling + shelf areas for all closets is calculated by finding areas of all sides plus ceiling and by finding areas of shelves and doubling because they are painted on both sides. The total closet area can be taken as 523 square feet.

The total plaster surface requiring paint in the basement stairway and the closets is 229+523=752 square feet. In the survey sheet both areas are shown but the paint quantity is figured and shown only for 752 square feet.

Item 130 shows that plaster priming paint covers about 800 square feet per gallon as does the second coat paint. Therefore one gallon is put into the survey sheet for priming and one gallon for second coat.

Basement Stairs and Platform. The stairs and platform are to receive three coats of paint, the final coat to be gray.

Fig. 17 shows that the platform is on a level with the kitchen. An easy and approximate manner to figure the area of platform plus steps is to assume the stairs and platform as being 10′0″ long and 3′0″ wide. The area would then be 10x3=30 square feet. To include the stringers the area can be increased to 40 square feet.

Item 114 shows that wood priming paint covers 600 square feet per gallon and the second and third coats about 700 square feet per gallon. The quantities here are so small that the contractor would figure one quart for all three coats and add to the priming coat to make it suitable for priming purposes and he would also add some color to the final coat.

Kitchen and Bathroom. Both of these rooms require one coat of priming, a second coat, and a final enamel coat.

The kitchen wall area is 314 square feet. The ceiling area is 89 square feet.

The bathroom wall area is 228 square feet. The ceiling area is 45 square feet.

Total wall and ceiling area for the two rooms is 676 square feet.

Item 130 shows that the priming coat covers 800 square feet per gallon and likewise the second coat. Item 131 shows that wall and ceiling enamel generally covers 700 square feet per gallon.

Note: Some enamels cover more and others less than 700 square feet per gallon depending on the brand and mixture.

The priming requires about 3½ quarts as will the second coat. The third coat will require about one gallon of enamel.

Doors. All doors must be stained, except the rear entrance door. There are fifteen doors. Item 151 bases the staining, shellacking, and varnishing for four doors at one quart of each material. Thus fifteen (approximately sixteen) doors will require four quarts of stain, four quarts of shellac, and four coats of varnish.

Spar varnish should be used on the exterior face of the front door entrance but the quantity is small. However, the window sills require spar varnish too. According to item 148 a pint would be ample. So one pint is put in the survey for doors but it is for sills as well.

Window Sills. All of the window sash and trim except the sill are enameled. The sashes must be stained, shellacked and varnished. The necessary spar varnish is listed on the survey with doors. One pint of shellac should be ample for the sills. Each sill can be assumed as about two square feet. There are 15 windows in Fig. 17 so the total sill area would be 30 square feet. Item 143 shows that stain covers about 500 square feet per gallon. Therefore one pint of stain will be ample.

Sizing and Calcimine. All ceilings except in the kitchen and bathroom must be sized and calcimined. The areas of the ceilings are figured and found to be as shown on the survey sheet.

The total ceiling area to be sized (gloss-oil) is 595 square feet. Item 133 shows that ½ gallon of gloss oil and one pint of benzene are necessary. Item 134 shows that 1½ pounds of calcimine are ample per 100 square feet. There is approximately 600 square feet so about nine pounds of calcimine are necessary.

Glusizing and Wall Papering. All rooms (including hall), except kitchen and bathroom must be glusized and papered.

Item 135 shows that one pound of glusize when mixed with water will cover 300 square feet. The accurate areas of the walls are shown in the survey sheets. The gross wall area for all rooms to be papered is 1,848 square feet. This does not consider deducting window and door areas. About six pounds of glusize are necessary for 1,848 square feet. However there are many windows and doors so only five pounds are put in the survey.

Item 136 uses Table I for estimating rolls of paper. The living

room is 12′x19′. However, the nearest dimension in Table I is 12′x20′ so the 12′x20′ is used. The ceiling height is 8′6″. Use the next shorter ceiling height of 8′0″ shown in the table. Thus 16 rolls would be required. There are five living room windows. We can

Table I. How to Estimate Rolls of Paper

Size of Room	8′0″ Ceiling	9′0″ Ceiling	10′0″ Ceiling	11′0″ Ceiling	12′0″ Ceiling	Yards Border	Single Rolls of Ceiling
8x10	9	10	11	12	13	13	3
10x10	10	11	13	14	15	15	4
10x12	11	12	14	15	16	16	4
10x14	12	14	15	16	18	18	5
12x12	12	14	15	16	18	18	5
12x14	13	15	16	18	19	19	6
12x16	14	16	17	19	21	20	7
12x18	15	17	19	20	22	22	8
12x20	16	18	20	22	24	23	8
14x14	14	16	17	19	21	20	6
14x16	15	17	19	20	22	22	7
14x18	16	18	20	22	24	23	8
14x20	17	19	20	23	25	25	9
14x22	18	20	22	24	27	26	10
16x16	16	18	20	22	24	23	8
16x18	17	19	21	23	25	25	10
16x20	18	20	22	24	27	26	10
16x22	19	21	23	26	28	28	11
16x24	20	22	25	27	30	29	12
18x18	18	20	22	24	27	26	11
18x20	19	21	23	26	28	28	12
18x22	20	22	25	27	30	29	12
18x24	21	23	26	28	31	31	14

assume six windows and deduct four rolls from sixteen rolls which leaves twelve rolls, the number of rolls estimated for the living room.

In like manner the dining room, bedroom No. 1, bedroom No. 2, and the hall require approximately 8, 10, 10, and 6 rolls respectively. This makes a total of forty-six rolls.

Paste. Item 138 shows that ½ pound of paste is sufficient for 100 square feet. There are roughly 1,456 square feet of paper, as the standard American rolls contain approximately 36 square feet. Thus about 8 pounds of paste would be required.

Openings. Window and door openings, framed openings, and

trim are known as "openings." In Fig. 17 we can assume the trim for five rooms as 5 openings (living room, dining room, bedrooms, and hall). There are 15 windows. There are 16 doors. (Kitchen door is not counted as it is enameled with the walls.) There are no framed openings. Thus 5+15+16=36 openings.

Item 111 shows that one quart of each coat of priming and second coat paint is required for 4 openings. Dividing 36 by 4 gives 9. Therefore 9 quarts or 2½ gallons are necessary for priming and the same for the second coat. Item 117 shows that the kind of enamel used on woodwork covers about the same as ordinary paint, so 2½ gallons are put into the survey.

Varnishing Floors. All floors, except kitchen and bathroom, must be filled and varnished. The closets are included. The areas of the various rooms are shown in the survey.

Item 140 shows that one quart of filler takes care of 175 square feet of surface. The total floor surface is 630 square feet. Dividing 630 by 175 gives about 3½ quarts of filler, which are necessary for the floor surface.

Item 141 shows that one gallon of varnish will cover about 700 square feet. The floor area is 630 square feet. That is close enough to 700 to assume one gallon of varnish. Two of varnish are necessary so about 2 gallons of varnish are required for the floor surface.

MATERIAL PRICING

The items in the quantity survey must be transferred to the estimating sheet. An examination of Figs. 13 and 14 will readily show how this is done. From Fig. 13 the item, the area—length—or pieces, and the estimated amounts of materials are transferred to Fig. 14.

The next step is to price the materials. The correct price per gallon, per pound, etc., is put in the material price column. Then the total material cost for each item is figured and entered in the column for material cost.

LABOR

The final step in this solution and of any estimate is the estimating of and pricing labor. The "Labor Records" have already been discussed in preceding questions and answers. The item numbers spoken of in the following refer to the "Labor Records."

Exterior Walls. The area to receive priming is 1,496 square feet.

In item 201 it is shown that a painter will average 100 square feet per hour. So the labor time for priming is 1,496÷100=14.96 or 15 hours. This 15 is put in the estimated hours column of Fig. 14.

The second and third coats really constitute 2 x 1,496 or 2,992 square feet. In other words, each coat means going over the exterior surface once and for two coats 2,992 square feet are gone over. The labor for the second and third coats is therefore 2,992÷100=29.92 or 30 hours.

Oiling Sash. Item 210 shows that 50 sash can be oiled in 2 hours. In this example there are 15 to be oiled, so we figure one-third of 2 hours or 40 minutes. Most contractors would allow one hour to be safe.

Putty. Puttying labor is included in other labor. (Item 219.)

Gutters. Item 204 shows that when gutters are in place it takes one hour for 250 lineal feet. In this example there are 80 feet which is about ⅓ of 250. Therefore ⅓ of one hour or 20 minutes would be allowed to paint the gutters. This amount is so small that it would be increased by most contractors to at least ½ hour.

Back Porch. Item 222 shows that a workman should paint about 200 square feet per hour. The area of the back porch is 58 square feet. Three coats must be applied, therefore we will consider the area 3 x 58=174 square feet. Thus about 1 hour is allowed for the three coats.

Basement Stairway and Closet Plaster. Here two coats are necessary so we increase the total wall area of 752 square feet to 1,504 square feet. Item 207 shows that one workman should paint about 200 square feet per hour. Then 752÷200=3.8 or approximately four hours.

Basement Stairs. Item 222 can be used here. The area is 40 square feet, so for three coats 3 x 40=120 square feet are considered. At this rate about ¾ of an hour would be assumed.

Kitchen and Bathroom. Item 207 shows that a workman can paint about 200 square feet per hour. There are 676 square feet of surface involved. The painting of window, door, and room trim is included. Three coats are necessary, so 3 x 676=2,028 square feet are considered. Then 2,028÷200= approximately 10 hours.

Doors. Item 237 shows that staining, shellacking, and varnishing each require one hour for 4 doors. There are practically 16 doors.

Then 16÷4=4. So a contractor would allow about 4 hours for each operation or 12 hours for staining, shellacking, and varnishing.

Window Sills. Item 230 shows that the window sills in an average six-room house can be varnished in one hour. For the sills, staining, shellacking, and varnishing are required. Three hours are therefore considered about right for all three operations.

Calcimining. Item 214 shows that a workman should calcimine at the rate of 100 square feet per ½ hour or 200 square feet in one hour. There are 595 square feet, or practically 600 square feet, to be calcimined, so about three hours time is necessary.

Gloss-Oiling. Item 212 shows that gloss-oiling is done at the rate of 1½ hours for 650 square feet. Therefore about 1½ hours are considered in this example.

Paper Hanging. Item 216 shows that for first-class work paper hanging goes at the rate of about one hour for 100 square feet of paper. It was previously figured that the square feet of paper is about 1,656 square feet. (One standard American roll contains about 36 square feet.) Therefore, 1,656÷100=16.56 or about 17 hours time is necessary.

Glusizing. Item 215 shows that glusizing can be done at the rate of 200 square feet per ½ hour. If we figure the same area as for the amount of paper, namely, 1,656 square feet, then 1,656÷200= approximately 8, and ½ of 8 gives about 4 hours time for sizing. This is allowing ample time because the 1,656 figure does not consider deducting window and door areas.

Paste. This labor is included with paper hanging.

Openings. Item 209 shows that for 4 openings one hour is required per coat. There are 36 openings. Therefore each coat requires 9 hours. The three coats then require 3 x 9=27 hours.

Filling Floors. There are 630 square feet of flooring to be filled. Item 220 shows that one workman can fill and rub off about 125 square feet in 45 minutes. In this example a good deal of the floor is closet space, so the area is considered a little more to compensate for irregular and numerous areas. The 630 is increased to 700 square feet. Then 700÷125=5.6 and 45 x 5.6=252 minutes or about 4 hours.

Varnishing Floors. Item 221 shows a rate of 1,500 square feet in 6 hours. The varnishing is done in two coats so we can consider

2 x 630=1,260 square feet. Thus 5 hours is the labor time required for varnishing.

MISCELLANEOUS ITEMS

Profit. The matter of profit cannot be stated exactly because it is affected by many factors. In this estimate a profit of 15% is assumed only for illustrative purposes.

Overhead. Overhead includes trucking, depreciation, and any other item that affects the cost of operations. The amount used in this estimate is only for illustrative purposes.

Summary. The general principles of estimate making have been covered in a typical manner. There are undoubtedly many other general methods used. This chapter has aimed at showing only one typical method for the reader's general information. It is felt that if this chapter is studied and thoroughly understood then all estimating methods will be easily understood. In estimating costs, the important thing is the inclusion, in proper amounts, of material and labor cost.

While the material, labor, and price data used herein were taken from existing and current estimates they still must be thought of as typical. The reader in California may have to make some changes in labor data. The same thing holds true for readers located elsewhere. Material prices vary considerably from season to season, so such prices as are used herein are wholly illustrative.

If ready mixed paint is used on a job, the quantity survey needs no further work other than to add up like items.

If mixed-on-the-job paint is used, the figures in the quantity survey must be interpolated in terms of white lead, oil, etc. This can readily be done by using such typical proportions as given in Formulas (1), (2), (3), (4), (5), (6), etc., in Chapter II.

INDEX